POPULAR WIRELESS, June 1st, 1935. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

SPECIAL "S.T." SET FOR ANY MAINS

Popular Wireless

AND TELEVISION TIMES

13 YEARS OF PROGRESS
★ ★
DOES THE ETHER EXIST?
★ ★
IS SYNCHRONISATION THE SOLUTION?
Etc., Etc.

EVERY WEDNESDAY PRICE 3D

No. 678.
Vol. XXVII.
June 1st, 1935.

In this Issue

The A.C./D.C. S.T.600

By JOHN SCOTT-TAGGART M.I.E.E., F.INST.P. FEL. I.R.E.

COSSOR 1935-36 RADIO

SUPERHET RECEIVERS

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A Battery-operated Superhet with 4 valves including Pentagrid Frequency Changer and Class "B" Output, 8" Moving Coil Loudspeaker. Cabinet generally similar to above, but somewhat larger to accommodate double capacity battery and suitable accumulator. **Price 9 Gns.**

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To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5.

Please send me, free of charge, full details of the new Cossor Super Heterodyne Receiver.

Name .....

Model .....

Address .....

Please state model required.

P.W. 1/6/35.

6906

POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR: N. F. EDWARDS. TECHNICAL EDITOR: G. V. DOWDING ASSOC. I.E.E

SAVED BY RADIO
SENDING THE DOCTOR
RAILWAY WIRELESS
ON EVEREST

RADIO NOTES & NEWS

TO AID AIRCRAFT
SOUND AND VISION
THE ULTRA-SHORTS
EIGHTEEN LOCALS!

Long-range Rescue.

THE Schenectady Radio Society recently broadcast from W 2 X A F a reconstruction of a real-life drama that is worth recording again—I believe I mentioned it long ago, when the incident occurred.

What happened was that a New Zealand amateur was listening to an air-pal in Alaska, when the latter's Morse went groggy and finally fizzled out in a suspicious manner.

The New Zealander didn't like the sound of it, so he called up other Alaskan amateurs and asked what they thought of it. They listened, suspected something wrong and, on investigation, found that their colleague had been overcome by fumes and would have died but for the helping hand of the New Zealander, ten thousand miles away.

Picnic Party.

OUTDOOR enthusiasts who like nothing better than to munch sandwiches while being munched by relays of gnats, mosquitoes, flies and other blood-lusters, will be delighted to hear of a picnic in June. It is arranged by the West Middlesex and East Bucks Branch of the Anglo-American Radio and Television Society on social (or bring-the-missus!) lines; and full particulars can be obtained from the Secretary, "Kingsthorpe," Willowbank, Uxbridge.

All Uxbridge-way readers of "P.W." who are partial to sunburn should find out about this, for advance particulars are decidedly attractive.

On Fanning Island.

IN our radio-equipped homes, with telephones everywhere and a doctor's lamp almost within sight of every front door, we seldom appreciate what wireless can do as a life saver.

From Fanning Island—one of the loneliest islands in the world—comes a remarkable story. The wife of one of the men at the cable station there was expecting a child, but the week before it was due the only doctor on the island died. A message was flashed to London explaining the situation, and as a result a wireless call was radiated from Rugby.

Before long the C.P.R. steamer Aorangi received the news and passed it on to an island steamer, the Dickenson. This vessel hurried to the island, the ship's doctor hastened ashore and twelve hours later a baby girl arrived. Both doing well, I'm glad to say.

Footplate Wireless.

THE indefatigable Reuter announces that all locomotives on the French State railways are to be equipped with wireless telephones to work on short wavelengths.

"P.W.'s" Birthday

Yet another year of radio has brought us to the anniversary of the date of first publication of "Popular Wireless," June 3rd, 1922. Thirteen years of radio progress have passed since that date, as memorable to many of our readers who are the proud possessors of copies of every issue of "Pop" as to ourselves.

And to signalise the advent of another birthday we are providing in this issue the description of a special "S.T." receiver, designed to operate on any mains—A.C. or D.C.—and at any supply voltage from 200 to 250. A set that, with its remarkable station-getting powers and its high selectivity, fully shows the amazing advances made in home constructor radio.

The idea is that the driver will be able to keep in touch with signalmen—an obviously attractive scheme if simplicity and complete reliability can be achieved in this way.

It is not generally known, I believe, that the Germans have also done quite a lot of experimenting on these lines.

Excelsior.

EVERYBODY knows that "the higher you go the fewer" the chances of finding broadcasting. But there is talk of placing Old Man Radio right on top of the world next year, when the 1936 Mount Everest Expedition sets out.

It seems that the last Expedition's success in speaking from above the Himalayan clouds to officials in Darjeeling has resulted in the evolution of better apparatus, and thus in the possibility of a broadcast to the world from the very top of it.

And now, I suppose, the modern poet will come out with a saga about a youth who bore, 'mid snow and ice, a banner with the strange device—"Announcior."

The Unfair Sex.

BLOODLESS sprite that I am supposed to be, I yet admit that I like to see a couple of stray curls escaping from under a slanty beret sometimes. But nevertheless I am a little scared at the enthusiastic way some of these girls are taking to "*our* radio." Only a few weeks ago I reported that Miss Harris, of Porthcawl, Glamorgan, was enrolling the fair sex under a wireless banner, and now I learn that in a fortnight she captured eleven entrants in Barry and five in Porthcawl.

A junior section, all under 14 years of age, is also going strong. That's the worst of these females—you show them something good, and every one of them, from girl guide to grandma, becomes acquisitive at once.

THE MIDLAND REGIONAL

A glimpse of the transmitting panels at the Midland Regional station at Droitwich. The power used is 50 kw., and the wavelength 296·2 metres. An article on this station appeared in last week's issue.

Under the Fishes.

WRITING cantankerously about my failure to praise the Post Office, "Ex-Linesman," of Abingdon, Berks, says: "Surely you know that in the last twenty-five years more than twenty submarine lines have been laid to the Continent. *Why not mention that in 'P.W.'?*"

My dear chap, if I mentioned in "P.W." all I know, there would be a breach of the peace. However, I will retaliate by asking "Ex-Linesman" if he knows how many pairs of wires were contained in that Anglo-Belgian cable, laid in 1932.

While "Ex-Linesman" is hurriedly consulting his books to find out, I will tell you other

(*Continued on next page.*)

THE MAN WITH THE BROADCASTING BEARD

fellows—there were sixty pairs of wires in that one cable. Add all the other cables and wireless, and you have some idea of the scope of Britain's network of communications to-day.

Fresh Air Stations.

THE new British direction-finding stations for aircraft seem to be getting on very well indeed, thank you. The Heston installation is the first in the London area to have the Marconi-Adcock direction-finding apparatus. To a great extent this new gear overcomes the old trouble of night errors that formerly made D.F. work so difficult except in daylight.

Heston's zone extends over twelve counties, and reaches from Leicester in the north to Selsey Bill and Newhaven in the south, and from Clacton in the east to Newbury in the west.

West of Newhaven, Portsmouth takes over, and will work in conjunction with Heston in taking bearings of aircraft making Channel crossings, including those on services to the Channel Isles.

Television Trouble.

MY battered bowler is raised in grateful salutation to E. T. W., of Rochester, who has provided me with the week's Big Laff. In a cheery letter he discusses most known forms of distortion including distortion of the gospel truth—and then he goes on to speculate about combined vision-and-sound distortion.

He pictures the television drama, when sound and sight fail to hang together correctly, and asks me to imagine on the screen a puling babe, left out in the snow, opening its tiny mouth and letting out a roar that shakes the firmament.

Or, equally surprising, the muscular hero, with ham-sized fist, holding that member aggressively to within one inch of the villain's nose, and *whispering* "See that?"

There won't be a dull moment when a television set goes wrong!

"Hello, Belfast!"

NORTHERN IRELAND seems to be bursting with progressive enthusiasm these days. I've had some exciting tit-bits about the new broadcasting station, and now comes news of an ultra-short-wave multiplex telephone link for the Stranraer–Belfast service. A very hot affair, believe me, I'm telling you.

The wavelength is only 4 metres—four times the distance between your boots and one of your waistcoat buttons—but they are going to superimpose *nine* simultaneous communication channels on the one wavelength! And what is more, only one receiver and transmitter will be employed at either end.

Standard Telephones & Cables, Ltd., are supplying the equipment, and they surely deserve a bouquet for evolving it!

Ultra-Shorts Again.

THERE are some persistent rumours "getting around and about" in connection with those "ultra-shorts" across the Atlantic to which I have already referred. Everybody who tells me about it knows a chap, who heard it from somebody else, whose young brother was there when it happened—you know the sort of thing, like ghosts, which never appear to you personally, but always to some trustworthy third party!

West London is given as the centre of the latest developments, and we shall be hearing some startling results from the test station erected there.

"When?" sez you. "Ultra-shortly, boy—ultra-shortly."

RADIO BREVITIES

The great annual racing festival of the Derby will be broadcast on June 5th. Mr. R. C. Lyle will again describe the race from a box on the top tier of the new stand. This year the new B.B.C. recording van will be going to the course to pick up sound records of the crowds, the racing and the festivities which may give added colour to the News Bulletin of the day.

* * *

Listeners who enjoyed John Watt's many productions, "Songs from the Shows," "Songs from the Films," "It Seems Only Yesterday," the "Crowded Hours" and many other variety programmes will be pleased to hear that this well-known producer is proceeding to the United States of America in search of new ideas and new talent, and also as a recuperative holiday after a long spell of production. It is possible that he may be heard over there in an American programme, but his main idea is to absorb any features and formulæ which may prove of use to British radio.

* * *

Excerpts from the Aldershot Tattoo of 1935 are to be broadcast in the National programme on June 13th, and in celebration of Silver Jubilee Year the Tattoo promises to be one of the most spectacular in the history of this annual event. The central theme of the Tattoo is to be the British Crown and its illustrious history; but the broadcast will of necessity be confined to the music of the massed bands, which will number twenty-six as compared with eighteen at last year's Tattoo, and the singing of favourite songs and hymns.

More Mike Noises.

EVIDENTLY disbelieving my recent reference to interference crackles being caused by the stiff dress-shirt of an announcer, F. T., of Dublin, wants to know if I have heard of the Russian professor's talk. It was on the subject of scraping and crackling noises, and a lifelike background of these was provided by the professor himself—he spoke up close to the mike, and his whiskersky and moustacheovitch scraped the mike and supplied the background!

So F. T. says; and I suspect this correspondent's name is Thomas, for he is doubtless the doug=tiest doubter who reads "P.W."

As a matter of fact, my own yarn of the crackling announcer is well authenticated. But I'm dead certain that F. T.'s is just flim-flam and the wicked imagination of his heart.

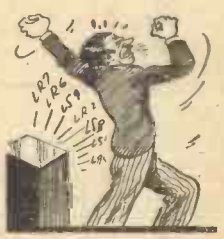
Lisbon's Latest.

READERS who listened in to the "P.W." tests with C T 1 A A some years ago—and didn't that little station hand us out a cheery plateful?—will like to know of Lisbon's latest: a short-wave directional broadcasting station for the Portuguese Department of Posts and Telegraphs, with a power of 20 kilowatts—no less.

This station will be used for the Portuguese colonial broadcasts on wavelengths between 14 and 50 metres, and, like the Daventry transmitters of a similar type, it will have a world-wide range. Don't start tuning for it immediately, though, for the date of opening is given as "the near future."

"One Man's Meat . . ."

AMONG my mail this week is a Cry from the Heart. It comes all the way from Buenos Aires, and speaks for itself, so I give it verbatim.



"The fact of F. J. S., Mill Hill, N.W., having received Buenos Aires programmes (as reported in POPULAR WIRELESS, 2/3/35, page 825) from stations LR3, LR4, LR5, LR6, LR9, LS8 and LS2 is good. *But*—he should have received more.

"All these stations, with others, about eighteen in all, are bunched together within a radius of less than ten miles. *I live within one and a half miles of five of them, so I know all about it*:

"And yet people grumble at the B.B.C.!"

Makes you think, doesn't it? Two local stations are bad enough, but *eighteen!*

They Say——

THAT Canada's first television broadcasting studio will be used more for demonstration than for service at first, because there are only two television receivers in Montreal.

* * *

. . . That Clapham and Dwyer are to broadcast regularly again as from the end of June.

* * *

. . . . That Andrew Stewart, new Programme Director for Scotland, is the sort of "Long Fellow" that goes a long way.

Honour for Sir Ambrose.

I HAVE to record yet another honour given to Sir Ambrose Fleming. The 85-year-old Lancaster-born inventor of the thermionic valve has been awarded that supreme distinction the Kelvin Medal. At the presentation Sir Kingsley Wood led a chorus of congratulations, which came from all parts of the world.

ARIEL

The A.C./D.C. S.T.600

By JOHN SCOTT-TAGGART
M.I.E.E., F.Inst.P., Fel. I.R.E.

In response to requests from readers all over the country Mr. Scott-Taggart has designed a special model of his famous S.T.600 for D.C. and A.C. mains users—a set that can be used on either mains without alteration.

AS the Western Brothers are in the habit of saying: "It was bound to happen in the end."

For nearly four years I have been pushed, prodded and even pestered by those voices in the wilderness of Ilford, Hull, Margate and other arid zones not yet fertilised by the beneficent currents of the Grid.

Why, I am asked, have I not produced a set for those unfortunate neglected readers who only have direct current laid on? Why have I catered *in extenso* for almost all classes of battery-valve users and those who rejoice in a generous supply of alternating current? Two or three readers have even attempted to spur me into designing a D.C. set by questioning my ability to do so. An antediluvian dodge.

Well, the fault is partly mine, but chiefly that of an editor who, in my respectful opinion, quite rightly believes in catering for readers in proportion to their numbers.

A Technical Consideration.

My own share is purely a technical one. The knowledge that the Grid system was extending its tentacles and embracing town after town which hitherto had worked off D.C. made it, in my view, a doubtfully wise proceeding to design a set exclusively for D.C. users. Having expended time and money, energy and oaths—for radio constructors are notoriously articulate—in building a D.C. set, no one would wish to scrap valves and components when their electric mains were hitched on to the alternating Grid system.

I have, therefore, been waiting for efficient universal valves which would enable the finished D.C. set to be used with at least equal efficiency on alternating-current mains. There has also been the question as to whether it is possible for me to cater for a comparatively small section of readers. However much I should like to do so, there are only six sets produced by me every year for the technical Press, and these six have to include a variety of designs of wide appeal: for example, radio-gramophones for battery and A.C. mains, special super-efficient-quality receivers, short-wave apparatus, and so forth. The D.C. "public" has of necessity received somewhat less consideration because it is a comparatively small public. Numerous good models have appeared under the names of other designers, and therefore the D.C. public cannot rightly claim to have been neglected.

The time has now become ripe for the issue of a universal receiver from my own laboratories, and I have been assisted by the new universal valves which have recently been produced.

SALIENT FEATURES OF THIS REMARKABLE RECEIVER

IT WORKS ON A.C. OR D.C. ELECTRICITY SUPPLIES.

IT INCORPORATES A SPECIAL MAINS FILTER TO PREVENT INTERFERENCE.

SPECIAL PRECAUTIONS HAVE BEEN TAKEN AGAINST SHOCK FROM THE ELECTRICITY SUPPLY.

IT INCORPORATES THE FAMOUS FEATURES OF THE S.T.600—THE EXTRACTOR—HIGH SENSITIVITY—EXTRAORDINARY SELECTIVITY.

THE TUNING IS EASY AND THE QUALITY IS EXCEPTIONAL.

IT IS ECONOMICAL TO RUN AND SAFE TO OPERATE.

It is now possible to produce a D.C. set which can also be used on A.C. at any time without any component alteration whatsoever to the receiver. The performance on D.C. of the set I am about to describe is exceedingly good, and on A.C. it is a little better. This slight improvement is because the voltages available on an A.C. set would usually be a little higher.

As an A.C. set pure and simple the present universal S.T.600 is approximately the same as that of an A.C. set designed solely as such. This is really a tribute to the valve industry in this country rather than to myself. I should certainly not hesitate to recommend anyone interested in an A.C. set to build the present receiver, and he would have the added advantage that if he "removed" or gave the set away (an extremely unlikely event for two or three years) the receiver would give satisfaction on whatever mains supply were fed to it.

Adjusting for Mains Voltage.

Only a very minor adjustment is required to compensate for varying supply voltages. This adjustment consists in altering the tapping of a resistor of wire. Such an adjustment is incidentally required of A.C. sets, in which latter case, however, it is a transformer tapping that is adjusted to suit the voltage of the A.C. mains.

The technique of A.C./D.C. set design presents a collection of new problems which require careful consideration and effective solution.

One of the major problems is introduced by the fact that the electric mains are connected directly to the set and not, as in the case of most A.C. mains receivers, via an iron-core power transformer. It is customary for electricity companies to earth one side of their electric mains, whether the current supplied is alternating or direct.

In the case of direct current you may find that at your house the positive side is connected to earth, while nearby they may have the negative side earthed. It is, therefore, necessary, in the first place, to have the mains plug reversible, since if you put the

plug in the wrong way you will get no signals. A second effect might be that the mains would be short-circuited through the receiver if the latter were connected directly to earth. A safety condenser (in the present case I have used 1 mfd.) is connected in the earth lead to obviate this short-circuiting, while a stopping condenser is also inserted in the aerial lead, since an aerial is also liable to cause short circuits, e.g. if it came in contact with the ground.

There are several precautions which had to be taken in designing an A.C./D.C. set to save the operator from possible electric shock. This problem has to be faced by all designers of such sets, whether for the general public or for home constructors. There is no more reason why you should get a shock on the A.C./D.C. S.T.600 than from any commercial receiver, unless, of course, you dabble inside the set when the mains are connected and the set is "alive."

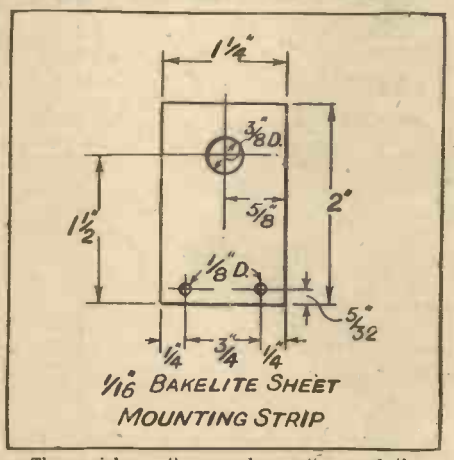
Special Safety Scheme.

One is more likely to do this on a home-constructed set than when the set has been bought ready made, but this timely warning should prevent all but the most foolhardy from carrying out adjustments or alterations while the set is connected to the mains. To save even the foolhardy from themselves I have arranged that the back of the set, i.e. the back of the cabinet, cannot be removed except by taking the mains plug out. If, therefore, the receiver is built according to specification (and I would not advise anyone to build it otherwise) you cannot obtain a shock unless you wilfully leave off the back and plug in and then carelessly dabble inside.

In an A.C. mains set the chassis is connected directly to earth and can be touched with impunity. In the case of an A.C./D.C. set, however, the chassis may be at, say, 200 volts potential to earth, and a shock may thus be obtained by touching it. The moral is obvious. If the chassis is in a cabinet one cannot conveniently touch it.

There is one hint which has to be given at this stage, and that is to warn constructors that the grub screws used for securing the control knobs to their spindles may be at high potential to earth. If these grub screws are touched a shock may thus be obtained. The tops of the grub screws should therefore be covered with wax or other insulating material. If they should project slightly above the surface of the knob it may be necessary to cover them with insulating tape. In practically all cases, however, the grub screw is set deeply in the knob, so that the top of the grub screw is below the surface of the ebonite or other insulating material of which the knob is made; the hole is then filled up with wax.

FOR "PANEL" CONTROLS



The aerial reaction, anode reaction, and the volume control are mounted on bakelite strips cut and drilled as in this diagram.

AN ECONOMICAL AND HIGHLY EFFICIENT UNIVERSAL MAINS SET BY BRITAIN'S LEADING DESIGNER.

In certain cases it is possible to obtain a short from the aerial when A.C. is applied to a set and no provision is made for obviating the trouble. In the present receiver there is an aerial coupler of small capacity which overcomes the effect naturally, while a fixed condenser in series with it is used as a double precaution to cover the possible contingency of the variable condenser breaking down.

The question of safety from shock makes it undesirable to have a pick-up connected to the receiver, and, in common with most commercial "universal" sets, the present receiver is not provided with gramophone connections.

It is a very simple matter to modify the set by additions so that records may be played, but I prefer to leave the responsibility to the constructor.

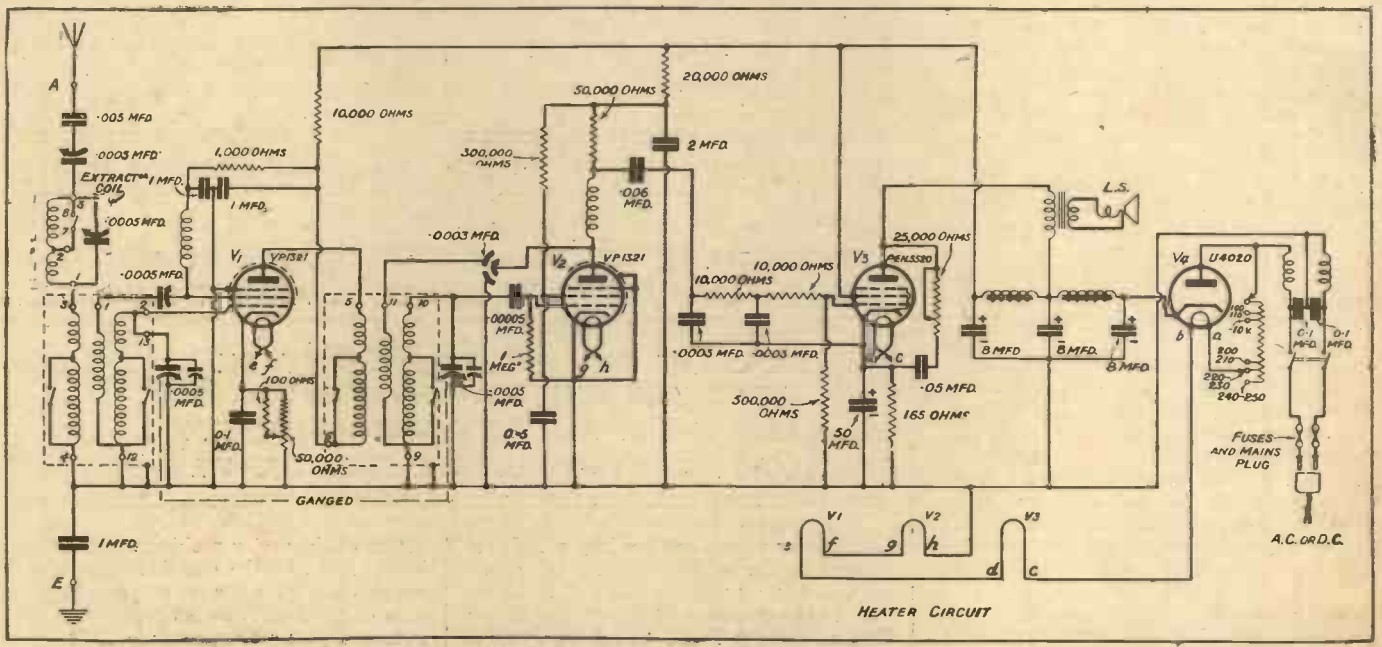
I hope that by now you will have gathered that although an A.C./D.C. set is not one to operate while having a bath, there is no reason why the constructor should shy at building such a set.

First-Class Performance.

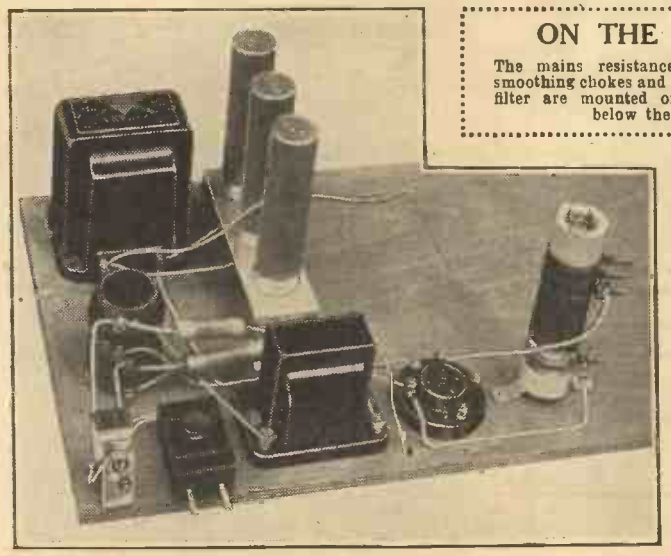
I have said that the problems facing such a set are just the same, whether the design is a commercial one or one primarily for the home constructor; but I should like to emphasise that the performance of the A.C./D.C. S.T.600, as regards selectivity, sensitivity and quality of reproduction, is very considerably better than that of commercial sets in the same class. I have made a particular point of comparing the performance of several commercial A.C./D.C. sets with that of this receiver, and although (perhaps because) the commercial set is tempting as regards price, the performance is well behind.

It is always my aim to produce something considerably better than commercial sets in the same category, and in the A.C./D.C. field I have found little difficulty in competing successfully with those commercial

THE FULL CIRCUIT OF THE A.C./D.C. MODEL OF THE S.T.600



All the wavechange switching is carried out in practice with one knob, the two points 7 and 8 for the Extractor switching being on the main coil unit.



ON THE TOP SHELF

The mains resistance, rectifier valve holder, smoothing chokes and condensers, and the mains filter are mounted on the shelf immediately below the loudspeaker.

designs which are so obviously of the stop-gap type.

The quality of reproduction of the A.C./D.C. S.T.600 is a real delight, and only comes second to the extremely elaborate Super-Gram de Luxe published last year and costing around £70. The speaker used on the present set is of very recent design, and excellent quality is also ensured by the absence of iron in the receiver circuit, except in the output transformer.

High Standard of Quality.

It is generally recognised that a high standard of quality can be more easily obtained on a straight circuit than with a superheterodyne, and therefore those who relish really fine musical results will find the present set very much to their taste. I can assure all such readers that I am enthusiastic about the quality of reproduction on this receiver.

There is a great deal about the present set to tempt those on A.C. mains to build it, and I make no bones about offering it wholeheartedly both to A.C. and D.C. users alike. The D.C. public can wholly rely on very excellent A.C. results should they go on the Grid, which is more than can be said for each and every commercial universal receiver, some models of which are designed to give fairly good results on D.C. (since it is essentially to D.C. users that they are sold), but are less effective on A.C.

One of the great problems in producing an A.C./D.C. set is the elimination of hum under all possible conditions of use. This has necessitated trying the set out on several different varieties of D.C. and A.C. mains, and every reasonable precaution has been incorporated to make the set universally satisfactory. The receiver is peculiarly free from hum and other extraneous noises.

Filtering the Mains.

There is provision for keeping high-frequency currents from the receiver circuit in the form of double filters. Actually the connections shown in the circuit diagram were finally adopted as the best with which to issue the design, although really one of the choke coils in the mains leads is out of action. These connections will prove satisfactory except in the rarest cases, where a tapping between the two condensers may be taken to a separate earth, i.e. not the one connected to the set. The experimenter may like to try other choke-and-condenser systems and a variety of filter arrangements, the ideal one depending upon the nature of the mains, the wiring, the earth lead, etc. The components are there, and a rearrangement of appropriate wires will provide for any eventuality, but, as already stated, the arrangements as described in conjunction with the drawings have given every satisfaction on the various electric mains on which I have tried the set.

Some hints have already been given as to the problems peculiar to A.C./D.C. sets. One of the greatest has been solved by the valve manufacturers. There is a high voltage between cathodes and heaters. The heater of an A.C./D.C. valve may be more than 300 volts peak negative with respect to the cathode. This calls for special insulation problems and may be a source of hum in a faulty design. The absence of a transformer saves the cost of one, of course. A double mains switch is required so as to switch off both sides. A double fuse is used as a safeguard in the event of a breakdown to earth.

Sometimes a fuse is dud, and I have experienced several cases where constructors obtained no results through a fuse in a mains set being faulty from the start. A fuse may be tested by any of the continuity methods described in my "Book of Practical Radio"; needless to say, the current passed by a fuse during a test should not be sufficient to "blow" it.

The method of connecting the heaters, or rather the order in which they are connected, is of importance. The heater of the detector valve is connected to the chassis from one end of the heater; this will be found to reduce hum.

Series Connection for the Valves.

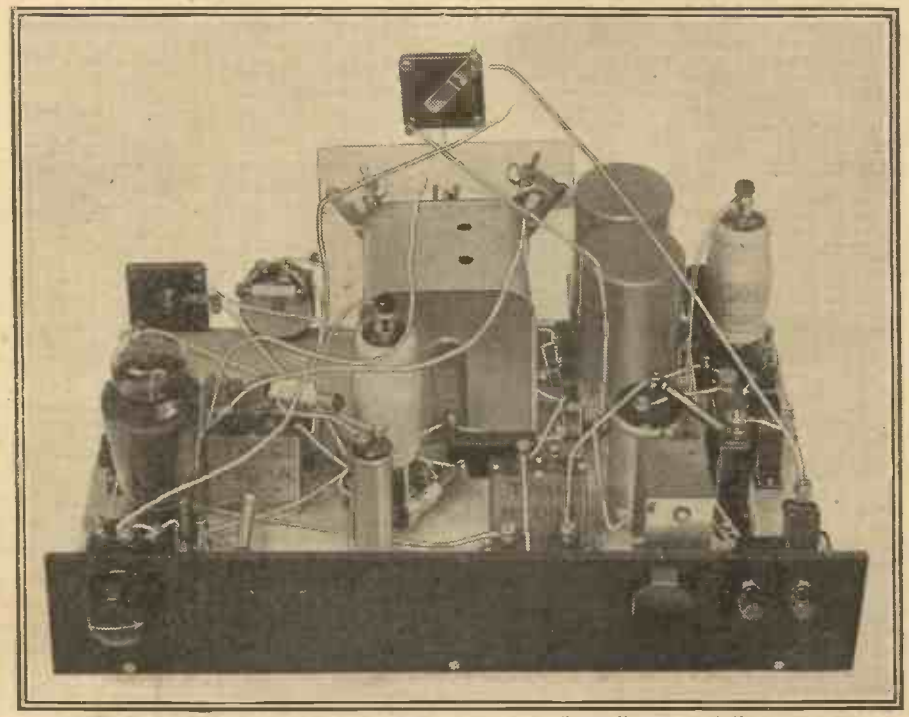
All the heater filaments are connected in series in the case of the A.C./D.C. valves described. The current in the case of each valve is the same and is rated at 200 milliamps. The valves are of different kinds, and the voltage across each heater is that which is appropriate to the function of the valve. The following table shows the voltage drop across the four valves, and the series resistor which is used to make the total voltage drops add up to the voltage of the mains. The voltage drop across the resistor will vary with different mains voltages, since you yourself will adjust this resistor.

The figures given are for 200 volts mains, but the voltage drop across the heaters of the various valves remains the same whatever the mains voltage may be:

Resistor	99 volts.
Rectifier	40 „
H.F. Pentode ..	13 „
H.F. Pentode ..	13 „
Output Pentode ..	35 „

A set of this type is only suitable for mains of 200 to 250 volts. The set would work on lower voltages, but, as with all

WITHDRAWN FROM THE CABINET



A general view from the back of the receiver, showing the "radio" portion of the set. A tone-control knob can be seen on the left of the terminal strip, while the familiar "Extractor" condenser is mounted near the other end, alongside the aerial and earth terminals. The aerial coupler is shown in position in the photograph, though actually it is fixed on the cabinet and is not mounted on the baseboard.

such receivers, the performance would be considerably reduced.

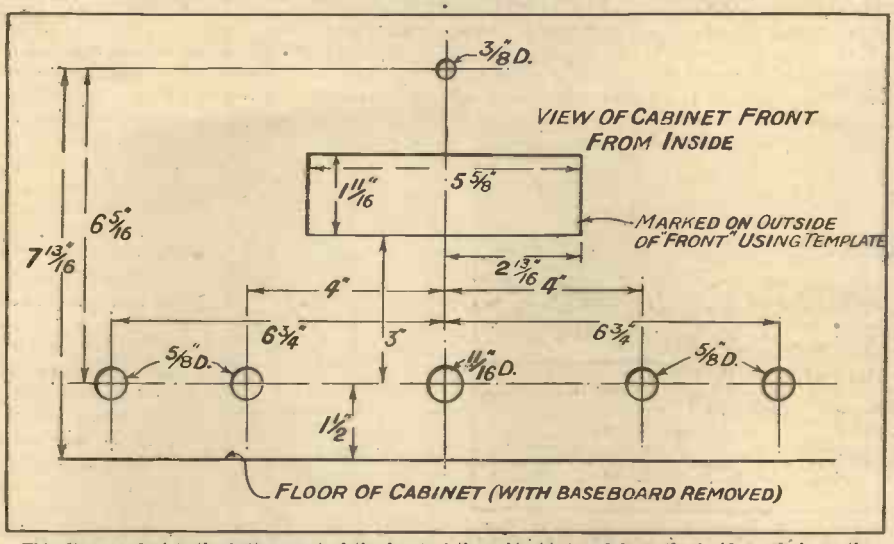
Adequate ventilation is required in a set of this sort, as several parts become hot in operation, e.g. the voltage-dropping resistor, the rectifier valve and the output pentode.

The Mains Plug.

I have already indicated that the mains plug must be reversible, because, when working off D.C., you may get no results whatever through the elementary mistake of having the mains plugged the wrong way round. The chassis may be at high potential to earth, depending on which side the mains are earthed. Alternating-current mains also have one side earthed, but, if you wished, you could reverse the mains plug so that the earthy side of the mains is connected to the chassis; but as the whole receiver is designed so that every precaution is taken, there would be no particular object in reversing the mains plug when A.C. is used, except that in certain circumstances a reversal of the plug when using A.C. might give better results from a background point of view.

As in nearly all my sets, soldering is avoided. Only in the

DRILLING THE FRONT OF THE CABINET



This diagram depicts the bottom part of the front of the cabinet, viewed from the inside, and shows the positions and sizes of holes that have to be drilled for the set controls. The escutcheon should be marked on the front, using the template provided by the condenser makers.

THE PARTS REQUIRED TO BUILD "S.-T.'s" LATEST TRIUMPH

Component.	Make used by designer.	Suitable alternative makes.
1 2-coil unit (S.T.600)	Colvern	—
1 Two-gang ·0005-mfd. V.C., with front trimmer	Polar "Unknob," Horizontal scale	J.B., Ormond
1 S.T.600 Ferrocart "Extractor" coil	Colvern	—
1 ·0005-mfd. "Extractor" variable condenser	Ormond (S.T.600 type with knob)	J.B., Polar
1 Aerial coupler, ·0005-mfd. solid dielectric	Graham Farish, L.M.L.	B.T.S., Polar, J.B., Ormond
1 Aerial reaction condenser, ·0005 - mfd. solid dielectric	B.T.S.	Polar, J.B., Graham Farish
1 Anode reaction condenser, ·0003-mfd. diff. solid dielectric	Graham Farish	B.T.S., Polar, J.B., Ormond
1 Volume control, 50,000-ohm, graded for variable-mu	Colvern S.T.5C	—
1 Tone control, 25,000-ohm, graded for variable-mu	Colvern S.T.5C	Erie
FIXED CONDENSERS (Mica dielectric)		
1 ·00005-mfd.	Lissen LN 5250	Dubilier, T.C.C., Graham Farish, Ferranti, Bulgin, Goltone
2 ·0003-mfd.	Lissen LN 11	T.C.C., Graham Farish, Dubilier, Ferranti, Bulgin, Goltone
1 ·005-mfd.	Dubilier 670	T.C.C., Ferranti, Graham Farish, Goltone, Bulgin, Lissen
FIXED CONDENSERS (Paper dielectric)		
1 ·006-mfd., tubular	T.M.C.-Hydra 600-V. D.C. wkg.	Polar N.S.F., T.C.C., Dubilier, Graham Farish, Lissen, Ferranti, Bulgin, Goltone
1 ·05-mfd., tubular	T.M.C.-Hydra 400-V. D.C. wkg.	Polar N.S.F., Ferranti, Bulgin, Goltone, Dubilier, T.C.C., Graham Farish, Lissen
3 0·1-mfd., tubular	T.C.C., type 250, 350-V. D.C. working	T.M.C.-Hydra, Polar N.S.F., Dubilier, Graham Farish, Lissen, Ferranti, Bulgin, Goltone
1 0·5-mfd.	Dubilier 9200	T.C.C., Graham Farish, Lissen, Ferranti, Bulgin, Goltone, T.M.C.-Hydra
1 1-mfd.	Dubilier 9200	Graham Farish, Lissen, Ferranti, Bulgin, Goltone, T.C.M.-Hydra, T.C.C.
1 1-mfd.	Graham Farish	Lissen, Ferranti, Bulgin, Goltone, T.M.C.-Hydra, T.C.C., Dubilier
1 1-mfd.	T.M.C.-Hydra, type 30, with terminals 300-V. D.C. working	Ferranti, Bulgin, Goltone, T.C.C., Dubilier, Lissen, Graham Farish
1 2-mfd.	T.M.C.-Hydra, type 30, with terminals 300-V. D.C. working	Ferranti, Bulgin, Goltone, T.C.C., Dubilier, Lissen, Graham Farish
FIXED CONDENSERS (Dry electrolytic)		
3 8-mfd.	T.C.C., type 502, 450-V. D.C. working	Dubilier, Polar N.S.F., Ferranti, Bulgin

Component.	Make used by designer.	Suitable alternative makes.
CONDENSERS (*Cont'd.*)		
1 50-mfd.	Dubilier 3001	Ferranti, T.C.C., Bulgin
FIXED RESISTORS		
1 100-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin, Graham Farish
1 165-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin
1 1,000-ohm 1-watt	Erie	Polar N.S.F., Ferranti, Bulgin, Graham Farish, Dubilier
1 10,000-ohm ·5-watt	Ferranti G.H. ·5	Dubilier, Erie, Bulgin, Polar N.S.F., Graham Farish
2 10,000-ohm 1-watt	Erie	Ferranti, Bulgin, Graham Farish, Dubilier, Polar N.S.F.
1 20,000-ohm 1-watt	Erie	Bulgin, Graham Farish, Dubilier, Polar N.S.F., Ferranti
1 50,000-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin
1 300,000-ohm 1-watt	Erie	Dubilier, Ferranti, Polar N.S.F., Bulgin
1 500,000-ohm 1-watt	Erie	Ferranti, Polar N.S.F., Bulgin, Dubilier, Graham Farish
1 1-megohm 1-watt	Erie	Polar N.S.F., Ferranti, Bulgin, Graham Farish, Dubilier
1 Mains resistance	Bulgin M.R.36	—
1 Mains H.F. choke	Wearite H.F.11	—
1 Aerial reaction choke	Lissen LN5092	B.T.S., Graham Farish "Snap"
1 Anode reaction choke (screened)	Graham Farish H.M.S.	Wearite, Bulgin, Varley
1 L.F. choke	Varley D.P.10	R.I., Ferranti, Wearite
1 L.F. choke	Ferranti B.8	Varley, R.I., Wearite
3 7-pin valve holders	Benjamin	Bulgin
1 5-pin valve holder	W.B.	Bulgin
1 Double-pole on-off toggle switch	Bulgin S.88	—
1 Safety fuse holder and mains connector	Bulgin F.18	—
1 Standard 5-amp. 2-pin socket	Bulgin P.29	Goltone
1 Permanent-magnet moving-coil loudspeaker	Rola. Special type for A.C./D.C. S.T.600	—
1 Cabinet, with shelf and baffle	Peto-Scott	—
1 Terminal strip, 16" × 3" × 1/8" ebonite	Peto-Scott	—
3 Bakelike mounting strips, 2" × 1½" × 1/8"	Peto-Scott	—
1 Bracket for mounting toggle switch	Peto-Scott	—
1 Bracket for mounting 8-mfd. electrolytics with terminal	Peto-Scott	—
1 Baseboard, 16" × 10" × 1/8" "Metaplex" as for S.T.600	Peto-Scott	—
2 Terminals	Belling-Lee, type R	Clix
2 Anode clips	Belling-Lee, No. 1167	—
Connecting wire, mains flex, screws, etc.	—	—

elaborate Super-Gram de Luxe was there any soldering, and the complexity of this receiver and the fact that it would be built by experienced constructors justified this. The absence of soldering means that there are no dial lights on the present set, since the lamp holders are fitted with soldering tags.

RECTIFYING AND SMOOTHING

This photograph shows the mains smoothing and rectifying portion of the set in position in the cabinet. Note how the electrolytic condensers are mounted to run down beside the loudspeaker.

* * *

Below we have the whole set in position. The speaker is screwed to the baffle supplied by the cabinet makers, and the top shelf slides in and runs under the baffle. Below, the rest of the receiver is housed, all sliding in except the aerial coupler, which is fixed to the front of the cabinet.

If it is desired to have the dial lights "on," this should be done after the set has given every satisfaction without them. Actually the problem of dial lights is far more complex than would appear, and even if there were terminals fitted I should probably advise the set to be built without the lamps at first. On an A.C. set it is a very simple matter to take the current for the pilot bulbs from a four-volt winding on the power transformer—normally the same winding that provides the heaters with current. In the case of an A.C./D.C. set the only satisfactory way is to connect the

JOHN SCOTT-TAGGART'S GREAT S.T.600 FOR ANY MAINS.

dial bulb in series with the heaters of the valves. There is, however, a risk in doing this, because if the filament of the bulb burns out, instead of perhaps 6 volts being developed across the bulb, there will be practically the whole voltage of the mains, and arcing may occur. There is, consequently, some risk of fire.

Shunting a Dial Light.

This trouble can be overcome by shunting the lamp with a resistor, so that, even if the dial lamp burns out, there will be no arcing, since the voltage across it, although larger than normal, will yet be comparatively low, say four times the normal. An additional advantage of such a shunt resistor is that if a dial lamp burns out, the set will not be put out of action, as it otherwise would.

Details of suitable resistors may be obtained from A. F. Bulgin & Co. Meanwhile, I emphasise that it is best to connect the set as described without the dial lamp.

As regards operating notes, apart from the usual ones which apply to the other S.T.600 receivers, it is important not to disconnect anything without having first switched off the mains. This is a standard rule applicable to all such receivers. Dabbling inside the set with the mains "on" is also *verboten*. A less obvious recommendation is to avoid disconnecting the earth lead when the set is working off A.C. In such circumstances a shock might be obtained, and a spark may occur on connecting or disconnecting the earth lead. In general it is inadvisable to connect or disconnect anything at all on an A.C./D.C. set without switching off the set. This hint is necessary because internal dabbling has to be very deliberate, since I have provided a safety back to the set which prevents any intentional touching of internal parts while the mains are on.

There is rather a tendency on the part of designers for the home constructor to skip the subject of careless handling of mains apparatus, on the theory that the word "shock" will scare timid constructors. Actually the ordinary shock you are liable to get by doing something foolish is not alarming when dealing with ordinary mains voltages, but nevertheless I am a believer in inculcating a respect for anything over 50 volts.

Trimming Details.

The only disadvantage of caution in a receiver like this is that trimming the gang condenser must be carried out by making an adjustment with the receiver switched off, and then noticing the results when the set is switched on. The alternative is to use a screwdriver or other suitable instrument with an insulated handle and to carry out the adjustment with the set "alive," taking care not to touch the chassis or other part of the set.

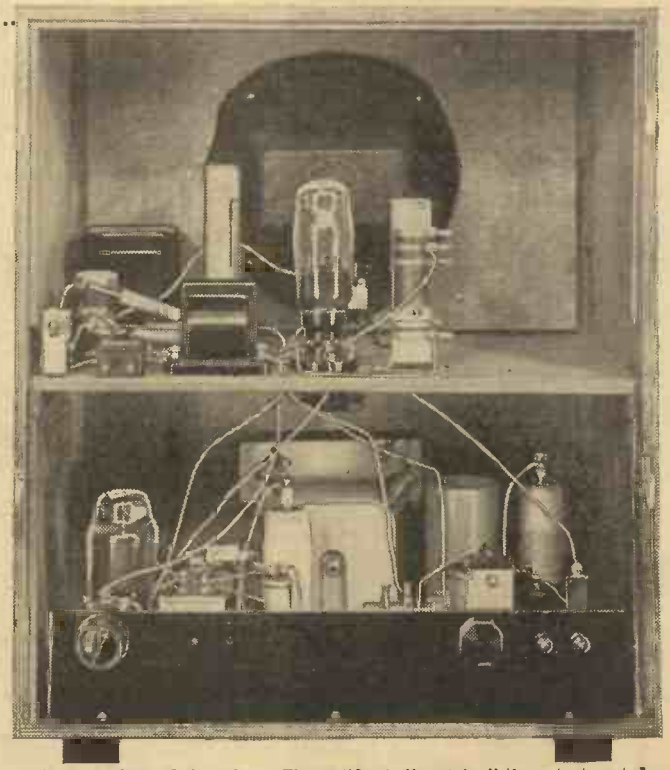
As a matter of fact, on this particular receiver trimming is extremely simple, since there is a front trimmer which you can use when operating the receiver. The other trimmer is a preset condenser, forming part of the rear section of the gang condenser, and all you have to do is to set this trimmer to such a value (as small a capacity as possible, of course, so as not to restrict the lower tuning range) so that an optimum (i.e. best) tuning point may be obtained throughout the range of wavelengths on the front trimmer.

Keep the Capacity Low.

There is thus no need to alter the rear trimmer while the set is alive. It can be altered in capacity in small steps with the set off; after each alteration the set can be switched on and the front trimmer tried. Too much rear trimmer must not be used, if possible, because this will prevent the tuning down to some of the stations at the very bottom of the medium waves. Incidentally, the scale on this condenser is marked in wavelengths, so that it is desirable to maintain these readings correct, and this will not be the case if the rear trimmer is set at a wrong value. It is, of course, more important that the set should trim correctly than that the scale should be dead accurate.

Let us now consider the radio circuit of this A.C./D.C. set. In general, the circuit very much resembles the battery S.T.600. It has an aerial coupler, an Extractor circuit which is tuned to the wavelength of an overpowering local station, and it has

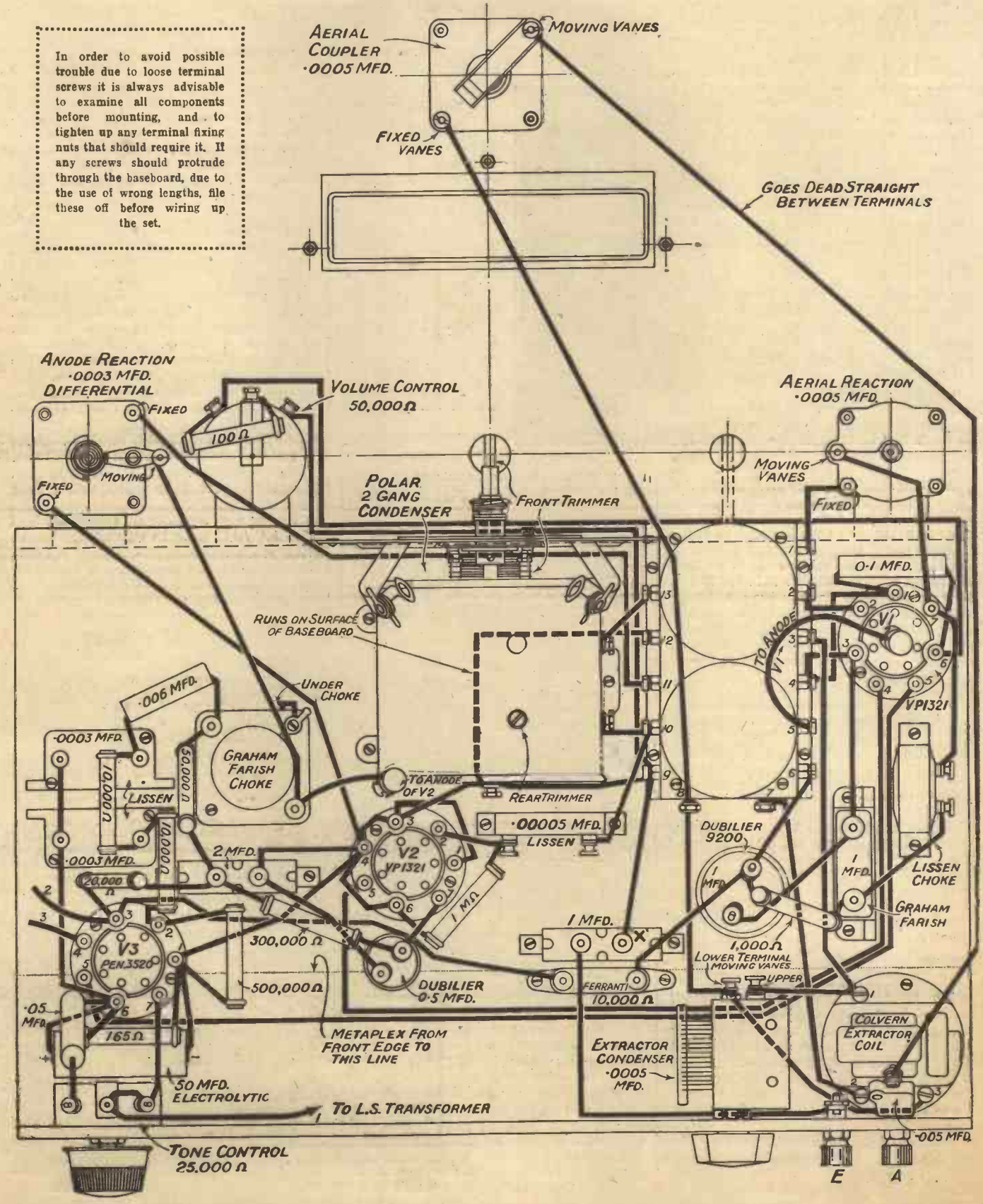
FITTED IN POSITION



Note the position of the valves. The rectifier is "upstairs," the output pentode is on the left of the lower section of the set. The other two valves are the H.F. screen pentodes in the H.F. and detector valve holders.

THE LAYOUT AND WIRING OF THE RADIO CHASSIS

In order to avoid possible trouble due to loose terminal screws it is always advisable to examine all components before mounting, and to tighten up any terminal fixing nuts that should require it. If any screws should protrude through the baseboard, due to the use of wrong lengths, file these off before wiring up the set.



You will be able to do most of the wiring from this diagram. The connections of the " power pack " are shown on the next page. Don't forget to lay the lead (shown dotted) under the variable condenser before screwing down, or you may have difficulty in putting the wire in position.

double-reaction controls; that is to say, reaction may be applied to the aerial circuit or to the anode circuit or to both in order to get greater selectivity, and greater sensitivity on very weak stations or when an extremely small aerial is used.

The high-frequency amplifying valve is of the H.F. pentode type, and the detector is also an H.F. pentode, as was the position in the case of the battery set. Leaky-grid rectification is used and resistance coupling to the output valve is employed.

The output valve is an extremely sensitive pentode, and this, in combination with the sensitive H.F. pentode detector, enables us to get all the sensitivity we require by a single stage of low-frequency amplification, and that stage a resistance-capacity coupled one.

The High-Frequency Filter.

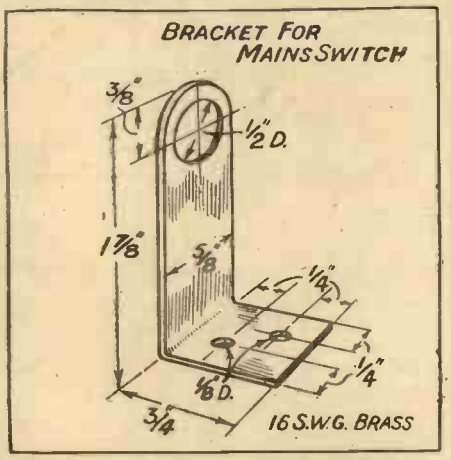
Note that the high-frequency currents are kept away from the input of the output valve by means of a filter arrangement consisting of two 10,000-ohm resistors and two ·0003-mfd. fixed condensers.

Tone control is obtained by means of a fixed condenser, ·05-mfd., and a 25,000-ohm variable resistance, which is really a potentiometer connected as shown in the circuit; the advantage of this arrangement of the connection to the potentiometer is that should any faulty contact occur between the slider and the resistor, there would still remain the 25,000-ohm maximum resistance in circuit, and this would be sufficient to prevent any dangerous rise in maximum anode voltage.

The loudspeaker used is of the latest type manufactured by the company concerned, and the transformer is matched to suit the particular output valve chosen for this receiver. The speaker is of the permanent-magnet moving-coil type.

The current supplied to the anode circuits of the first two valves and the screens of all three valves is smoothed by a double filter arrangement consisting of two iron-cored chokes and associated 8-mfd. condensers.

FOR THE ON-OFF SWITCH



The bracket for the on-off switch is made of brass and cut to the dimensions shown. Alternatively, of course, a bracket can be purchased ready made.

The current for the anode of the output valve is smoothed by a single smoothing circuit.

The general construction of the receiver follows the usual lines of having an upper shelf containing the mains rectifier and voltage-dropping resistance, together with smoothing chokes and condensers. The baffle is not connected to the shelf, as is done on some designs. The main portion of the receiver is mounted on a "Metaplex" baseboard, which slides on to the floor of the cabinet. Various controls spindles poke through the front of the cabinet as usual, some of the controls being themselves mounted on bakelite brackets.

Constructional Notes.

Collect and examine the required components. Bend up the soldering tags on the valve holders; the tags may be bent till they point vertically upwards, this reducing capacity to earth and leaving more room.

Tighten terminal fixing nuts (not the terminal heads) on components.

The radio portion of the receiver should first be tackled. It is mounted on a $\frac{5}{16}$ in. × 16 in. × 10 in. plywood board with "Metaplex" over a large portion of the upper side. Fix all the radio components except the two-gang condenser. Mark out and drill terminal strip (unless bought ready drilled). Fit the two terminals to terminal strip. Fit terminal strip to baseboard. Fit the tone control (25,000-ohm potentiometer) to the terminal strip.

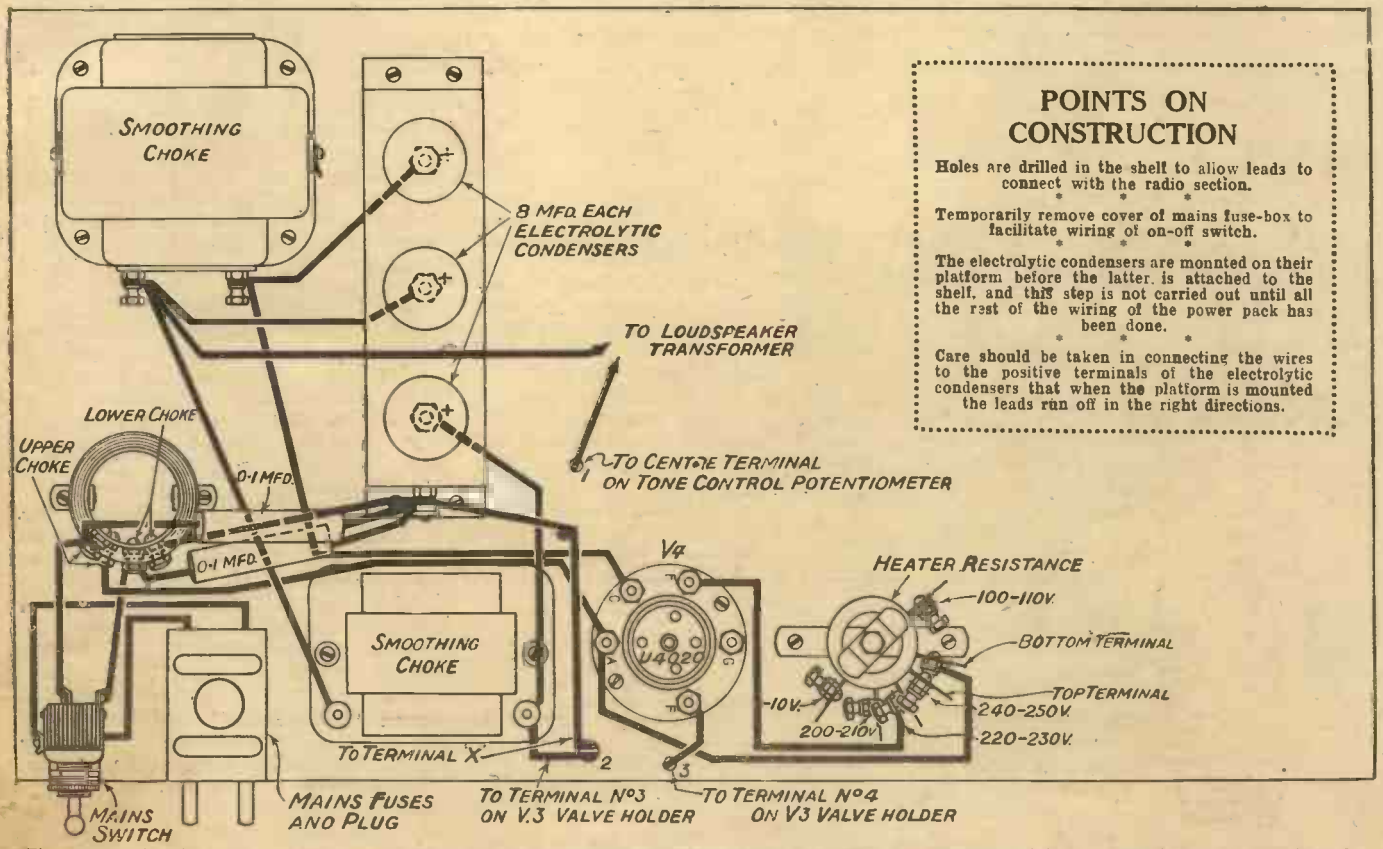
Fit on bakelite-sheet mounting strips the aerial reaction condenser (·0005 mfd.), volume control (50,000-ohm) potentiometer, anode reaction condenser (·0003-mfd. differential).

Wire all components on radio chassis (which term now includes terminal strip and mounting strips) except the two-gang condenser—which, of course, is not there!

Prepare the following four wires before mounting the two-gang condenser:

The wires from terminals 9, 10, 12, 13 on the two-coil assembly for subsequent

THE CONNECTIONS OF THE POWER SECTION OF THE SET



POINTS ON CONSTRUCTION

Holes are drilled in the shelf to allow leads to connect with the radio section.

* * *

Temporarily remove cover of mains fuse-box to facilitate wiring of on-off switch.

* * *

The electrolytic condensers are mounted on their platform before the latter is attached to the shelf, and this step is not carried out until all the rest of the wiring of the power pack has been done.

* * *

Care should be taken in connecting the wires to the positive terminals of the electrolytic condensers that when the platform is mounted the leads run off in the right directions.

The power section is arranged to fit on a shelf just below the loudspeaker, and care must be taken that the disposition of the components is such that they do not foul the speaker magnet.

c

onnection to the two-gang condenser. Turn the knob of the two-gang condenser until the pointer is opposite 200 metres on the scale. Fit two-gang condenser. Connect the four wires from the two-coil assembly. Connect the suppressor grid terminal on the detector valve holder to the two-gang condenser frame terminal (the terminal at the back).

The power section is now dealt with. Remove shelf (plain plywood) from cabinet. Drill the holes in the shelf for the connecting wires to radio chassis. Mount on the shelf all the components except the three 8-mfd. can condensers, but including the mains on-off switch, which is mounted on a metal bracket.

Temporarily remove the cover of the safety fuse holder to make some of the terminals on the main switch more accessible.

Wiring the Power Section.

Carry out all the wiring except to the three electrolytics, which, of course, are not there! (Make sure that the mains voltage dropping resistance is correctly tapped for the mains voltage to be used.)

Mount the three electrolytic 8-mfd. condensers on their aluminium bracket. Prepare the three wires for connection to the positive terminals of the three electrolytics. In the case of each of these wires connect the correct end to its appropriate positive terminal in such a way that when the bracket is later fixed to the shelf the terminal on the bracket itself will come in the position shown in the drawings.

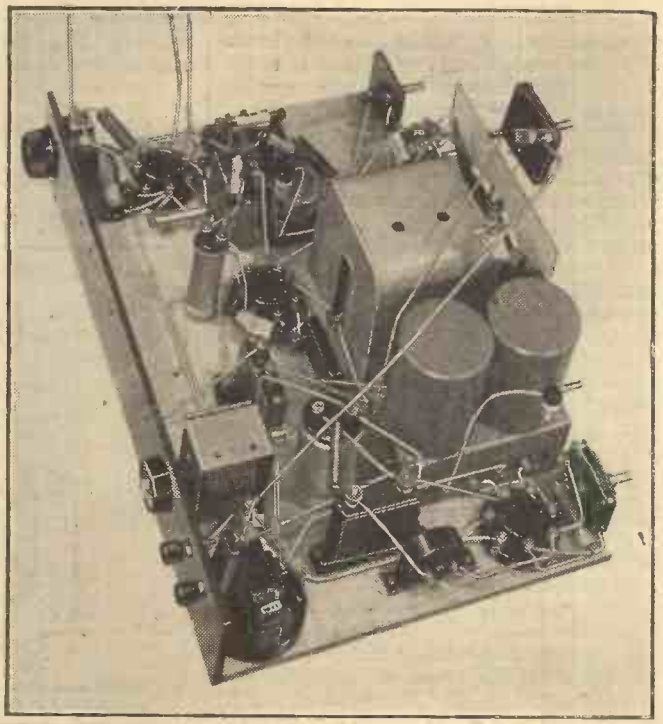
Fit the bracket (on which the electrolytics are mounted) to the shelf.

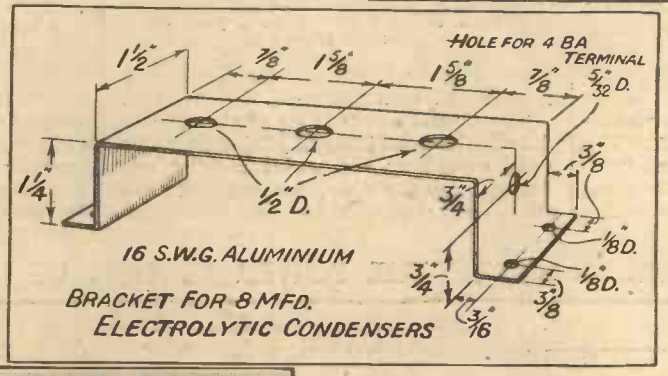
Complete the connections to the three electrolytic 8-mfd. condensers and the terminal on the bracket supporting these condensers.

Unless the cabinet is ready drilled, mark on the inside of the cabinet front the positions of the holes for the aerial reaction condenser, wavechange switch, spindle only of two-gang condenser, volume control, anode reaction condenser and aerial coupler.

Drill pilot holes from inside of cabinet. Lay cabinet on table so that its front is horizontal and uppermost. Lay the template provided with the two-gang condenser on to the cabinet front so that the centre pilot hole comes under the position of the spindle hole marked on the template.

Fix the template by two drawing-pins



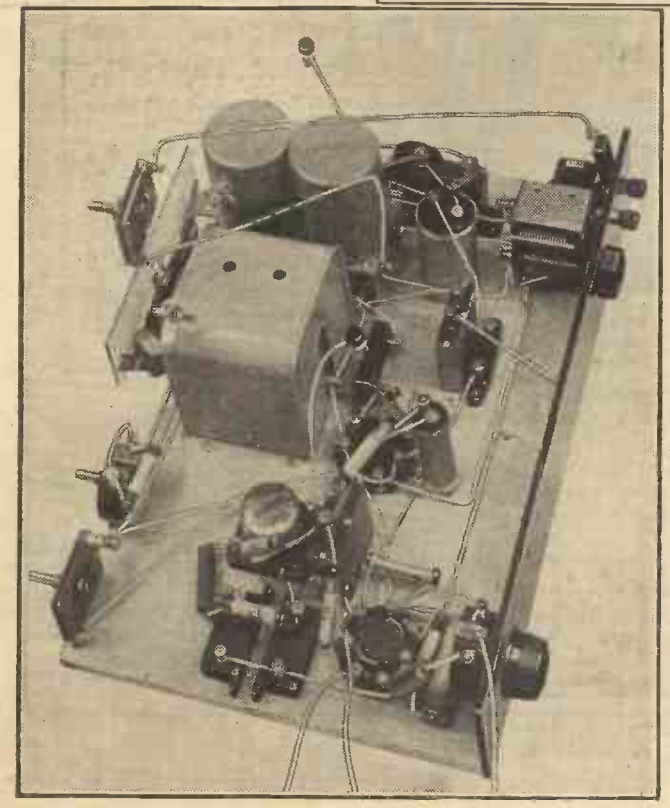


THE RADIO SECTION.

A metallised baseboard is used for the radio part of the set, the metallising stopping short so that a strip of plain wood running along by the terminal strip is provided. The photographs do not show this very clearly, but its width is such that the "Extractor" coil does not lie over "Metaplex."

* * *

On the left is a drawing of the bracket for the electrolytic condensers. Note that these condensers are of the "thin" type, and not as large in diameter as many of their brethren.



THE L.F. END is clearly shown here. There is nothing crowded about the layout, everything having sufficient room to enable wiring to be carried out quite easily. Though there are two holes in the variable condenser, only the rear one gives access to a trimmer.

pushed into the part of the cabinet front which is to be cut out. Mark the centres of the three escutcheon fixing holes, and, having done this, mark the chain of holes. Remove the template, drill the three escutcheon fixing holes and then the chain of holes.

The rectangle of wood will probably fall out at this stage; if not, cut wood separating holes with a penknife.

Smooth with a file the edges of the rectangular hole. Fit the escutcheon and, with extreme care, cut off with a hacksaw blade the surplus length of the upper fixing bolt of the escutcheon. The object of this is to ensure that the condenser pointer will not catch against the end of this bolt. Drill out (from the front) to correct sizes the pilot holes already prepared.

Mounting the Loudspeaker.

Dust out the chips of wood and remove all other loose matter from the cabinet.

Make sure the loudspeaker baffleboard is firmly bolted to the cabinet front. Lay the cabinet face downwards on a soft cloth. Lay the loudspeaker symmetrically over the hole in the baffle and mark the positions of the four fixing screws. Remove the loudspeaker and prepare holes with a bradawl for the four loudspeaker fixing screws.

Dust out cabinet once more, and then fix the loudspeaker to the baffle. I used four ¾-in. No. 6 round-head brass screws.

Stand cabinet upright. Fit aerial coupler on cabinet "front." Slip radio chassis into position, making sure that all control spindles and the condenser pointer can move freely. Fix radio baseboard by means of a screw through the baseboard into the floor of the cabinet.

Make connections to aerial coupler. Slip the power chassis into position.

(*Continued on page* 338.)

MAZDA

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R.M.44

BARRY KENT CALLING

News and Views from the "Big House."

THE B.B.C. is getting much exercised about "adolescents." There is to be a big autumn drive to interest the youth of the country in the early and middle "teens." The idea is to build this activity round a weekly commentary, covering all the supposed interests of the adolescents of both sexes.

To sweeten the pill of education and propaganda, there is to be a discreet mixture of adventure and some "clean fun." The idea has possibilities, but I would feel happier about it if there was not so much talk of the "good" it will do. Let's go for entertainment, and, if that is successful, the "good" will follow.

* * *

B.B.C. and Staff Housing.

The Administration of the B.B.C. has circularised all the staff to warn them to avoid getting entangled in schemes of house purchase. Staff are recommended to rent rather than to buy. The reason for this is that the B.B.C. wishes to make all its staff more mobile, and will not be "let in" for compensation claims on the ground of dwelling-house commitments.

* * *

Ice-cream for the "Troops."

There is now a regular service of ice-cream vending from room to room in Broadcasting House. The idea is to "humanise" the place more; to induce staff to get together in little ice-cream parties, and so on. When I inquired whether those who preferred beer to ice-cream would be catered for also, "the B.B.C. had nothing to say." But I leave to the Director-General and the Governors the constructive suggestion that discreet beer-parties would be a great additional aid to "humanising"!

* * *

The "Ten-Year Book."

Some time ago there was a story that the B.B.C. was securing the photograph of each member of the staff for record purposes. I have been investigating this, and find that this applies only to the members of the staff who have completed ten years' continuous service and have received the bonus to which this entitles them, namely, ten per cent of a year's pay. Sir John Reith takes keen personal interest in the "Ten-Year Book"; he is extremely fond of the original staff that supported him in founding the business.

* * *

The Ullswater Committee.

This is the week in which expires the opportunity to apply to give evidence to the Ullswater Committee on Broadcasting. I understand that up to May 28th no less than 350 individuals and societies had written in or applied verbally to members of the Committee. The Committee is now engaged in sorting out the applicants because they cannot all be received. It is believed, however, that all applications on behalf of properly organised societies, clubs, or established firms will be accepted, some written and some verbal.

* * *

Col. Dawnay's Future.

Col. Alan Dawnay, who has been Controller of Programmes to the B.B.C. since September 1st, 1933, will hand over the job on October 1st next, when he takes command of the Irish Guards. It is understood in War Office circles that this command is a stepping stone to much more important appointments in the Army.

* * *

Variety Plans.

I have been looking through a list of variety programmes planned for the mid-summer period, and here are some:

July, 1st week.—Ernie Lotinga Revue; Jubilee Music-Hall; Stag Party Entertainment Hour; Carroll Gibbons and Boy Friends.

2nd week.—White Coons; Seven Cafés.

3rd week.—Cavalcade; The Red Sarafan; Sandy Powell's Album.

4th week.—Jubilee Gala; Seven Cafés; First Time Anywhere.

August, 1st week.—Ridgeway Parade; Jack Hylton's Party; One Band to Another.

2nd week.—Air-do-Wells; Round the Concert Parties; Seven Cafés.

* * *

More Money for Artists.

I know as a fact that when the Ullswater Committee recommend, as they will, that the B.B.C. receive much more licence revenue than at present, they will attach the condition that the fees for artists, instrumentalists, playwrights, authors, and composers shall be substantially increased. This will be a splendid development, not only helping the whole artist and author fraternities, but also meaning better programmes.

* * *

B.B.C. and "the Dogs."

I had occasion the other day to ask at the "Big House" whether they were going to do anything about the Greyhound Derby in July. There is an enormous public

(*Continued on page* 341.)

"LISTENERS DON'T LAUGH ENOUGH"

says our broadcasting critic and suggests that perhaps there is too big a percentage of food for intelligent thought.

IN planning my listening in advance I always earmark turns which I think might make me laugh. I find I am doing very little earmarking these days. B.B.C. programmes, it seems to me, aren't framed as if they were largely intended to produce laughter. There's plenty of entertainment in them, mark you, stacks of goodwill, and much to interest everybody. Perhaps there's too big a percentage of food for intelligent thought for some people.

That Music-Hall Bill.

But this question of real laughter-provoking fare! I have been thinking a lot about it lately. For instance, there was an excellent music-hall bill this week which, in spite of the two old-type comedians it contained, didn't produce a single honest-to-goodness laugh from start to finish.

* * *

You don't laugh at harmony kings, syncopators, crooners, etc., as a rule. While you admire their technique and finish, you never have to hold your sides. Nor do you laugh at people like Messrs. Flotsam and Jetsam. Their topical numbers, you say, are clever. They are. And you applaud. It's the same with their sentimental songs. Violet Loraine some years ago made us laugh. We didn't expect to the other night when she sang "Let the Great Big World Keep Turning." But we ought to have when she sang "The Gipsy Warned Me." Yet did we?

I am really beginning to think that listening-in and laughter are contradictions in terms. I think few listeners do switch on their sets in anticipation of having a good laugh. Music-hall and variety, generally speaking, have it as their special pigeon to create laughter. But these contain, so I think, too many clever rather than mirth-provoking turns to effect this.

* * *

More Funny Turns Required.

I rather envy some of these Continental turns that seem always to send their audiences into fits of laughter. Our own outside relays from the theatres and music-halls once used to, but lately they, too, seem to have gone in for the clever, interesting rather than funny turn. I thought Billy Merson might have broken the spell. Perhaps he did to a point, but his type of humour seems old-fashioned.

In spite of Billy Merson's remark to his partner that there are plenty of comedians about, I believe the contrary to be more correct. There aren't nearly enough—on the air, at any rate. Admittedly there are some good ones, who naturally, in view of the frequency of their appearances, can't keep supplying fresh stuff. The result is that they tend to fall a bit flat. I think that the comedians who make the fewest appearances make the biggest hits. Take Julian Rose, for instance. And Cicely Courtneidge.

(*Continued on page* 339.)

"JUBILEE SCRAPBOOK"

THE COUNTESS OF OXFORD AND ASQUITH describing the tense moments of August 4th, 1914, for the Columbia record that has recently been released.

Does the Ether Exist?

The sudden and unexpected recall of Professor Kapitza to his native Russia has robbed Cambridge of one of the world's most brilliant physicists: It has also—as our correspondent explains below—postponed an experiment of great scientific importance and of popular interest to all wireless enthusiasts.

NEARLY fifty years ago Professor Oliver Lodge (as he then was) began to try to prove the existence of the ether by making its movement alter the speed of light. After years of research, in the course of which he conducted a number of brilliant experiments, he failed to detect any ethereal motion. Nevertheless, he wrote in 1892:

"An experiment in which nothing is seen is never a very satisfactory form of a negative experiment; it is, as Mascart calls it, 'doubly negative,' and we require some guarantee that the condition was right for seeing what might really have been in some sort there."

What is more natural, therefore, than that in the year 1935 Sir Oliver, eighty-three years old but still absorbed in the advancement of science, should have anticipated with interest an experiment which Professor Kapitza proposed to make in the new Royal Society Mond Laboratory at Cambridge?

Very Concerned About It.

When I spoke to Sir Oliver in his beautiful house at Lake, near Salisbury, I found the great scientist more concerned over Kapitza's retention in Russia than over the indefinite postponement of the ether experiment. "It is a terrible thing," he said, "that such a brilliant man as Kapitza should be prevented by the Russians or anyone else from carrying on the marvellous work he was doing at Cambridge. The ether experiment was not by any means the most important work he would have done, but I was greatly interested in it.

"I went to Cambridge," Sir Oliver continued, "and Professor Kapitza showed me over his laboratory. We discussed the ether experiment and the possibility of making it soon. Einstein was anxious for him to make it, too, for Einstein's Theory rather disapproves of the ether. I hoped that the experiment would prove its existence, although, even if the experiment were a success, it is possible that others would put a different interpretation upon it. At all events, Kapitza might have succeeded, where others have failed, in altering the speed of light—a thing which Einstein says is impossible.

A Costly Experiment.

"It would have been a very costly experiment, perhaps £10,000—and, of course, so far as I can see, of no possible commercial value. But it would have been well worth making in the interests of pure science, and I don't think he will be able to carry it out in Russia."

Before I tell you how Sir Oliver described the proposed experiment of Kapitza, let us look at some papers which he kindly lent me. The first is an account of a lecture which Sir Oliver gave before the Royal Institution as long ago as April 1st, 1892. It is entitled "The Motion of the Ether Near the Earth."

In this he puts the question "Can matter carry neighbouring ether with it when it moves?" and he proceeds to describe an experiment which he conducted to see if "a lump of matter that you can deal with" would pull any ether along.

"I take a steel disc, or rather a couple of steel discs clamped together with a space between. I mount it on a vertical axis and spin it like a teetotum as fast as it will stand without flying to pieces. Then I take a parallel beam of light, split it into two by a semi-transparent mirror (Michelson's method), a piece of glass silvered so thinly that it lets half the light through and reflects the other half, and I send the two halves of this split beam round and round in opposite directions in the space between the discs. They may thus travel a distance of 20 or 30 or 40 feet. Ultimately they are allowed to meet and enter a telescope."

No Change Observed.

He then describes how it is possible to detect whether the two halves of the split beam have travelled round at the same or different speeds, and he sums up the result by saying: "Of real reversible shift due to motion of the ether I see nothing. I do not believe the ether moves. It does not move at a five-hundredth part of the speed of the steel discs.

"I hope to go farther, but my conclusion so far is that such things as circular saws, flywheels, railway trains and all ordinary masses of matter do not appreciably carry the ether with them. Their motion does not seem to disturb it in the least."

Later on he refers to the famous Michelson experiment, which failed to detect any movement of the earth through the ether; but in April, 1907, he published a paper in the "Philosophical Magazine" on "The Density of the Æther," in which he describes how he went a step farther with his steel-disc experiment, and, in fact, abandoned the discs altogether, using powerful electro-magnets instead. Theory seemed to show that magnetic force was nothing but a flow of ether, and if this were so then a magnetic field should carry light along with it.

Stronger Field Required.

Using his split beam of light, he tried to detect a difference in the speed of the two halves of the beam when sent round in opposite directions in the very powerful electric field which he was able to produce.

Well, Sir Oliver was clearly not satisfied with this experiment, for in 1919, in the May

(*Continued on page* 339.)

A BRILLIANT SCIENTIST

Professor Kapitza, whose valuable work at Cambridge is now at a standstill, owing to his recall to Russia. Sir Oliver Lodge says: "It is a terrible thing that such a brilliant man as Kapitza should be prevented by the Russians or anyone else from carrying on the marvellous work he was doing at Cambridge." The photograph below shows one of Professor Kapitza's assistants conducting an experiment in connection with the liquefaction of gases.

Is SYNCHRONISATION the Solution?

asks ALAN HUNTER

WHEN, two years ago, I went down to Somerset for the opening of West Regional at Washford I knew that the B.B.C. had only half done a job of work. Yet I had to sympathise with the engineers. They had more stations than wavelengths. That was the simple truth.

It was claimed that by putting up the West Regional at Washford, on the Somerset coast, a greater part of South Wales would be reached than with a station actually in Wales. The reason being that radio waves travel more easily over sea than land.

A far wider area of uniformly good signal strength was possible for Wales from Washford than from any point in Wales. Only a small area would have received a really strong signal from a Welsh station, owing to the hilly nature of the country.

At the same time, by putting West Regional at Washford it was maintained that the greater part of the West Country would also receive a reasonably good signal. And, so far as Somerset and the nearer parts of Devon are concerned, this has proved fairly correct.

The emphasis was all the time on the technical side, it will be noted. And that is why I realised the job was only half done. During his informal chat to us in the station building Mr. Appleton, the station director, did nothing to allay our fears—despite all his charming assurances of goodwill on both sides of the Bristol Channel.

It is common knowledge that listeners in certain parts of the country are not properly catered for by the existing B.B.C. network. The B.B.C. is fully aware of this and, in an attempt to overcome the difficulty, more stations are being built. But, asks our contributor, where are the vacant wavelengths ?—the European waveband is already overcrowded as it is. Will the B.B.C. bring into general use a common wave, as is employed at present for the three "little Nationals" ?

Impossible Programme Task.

What stood out a mile was the fact that the director had an impossible programme job in front of him. Simply because he had a station designed to serve at one and the same time two different countries—West England and South Wales.

The cry would always be, we saw, more Welsh programmes for Wales. Equally it would be for more English-speaking programmes for the West. To please one it would be necessary, more often than not, to irritate the other.

It is no use saying now that all this was perfectly obvious and that the B.B.C. must have been mad to attempt to serve two countries with one station. For what to them was even more obvious was the fact that there was only one possible wavelength available.

The idea of synchronisation was not nearly as well understood as now. The ruling thesis was: One station, one wavelength. That is really why the ill-starred West Regional came into being against all common-sense programme demands.

Almost inevitably there has been a constant antagonism. Welsh listeners have complained with just as much justice as West Country listeners have. It was an impossible task to please them both.

Nor did the coming of Droitwich really provide any solution to this fundamental Regional difficulty. Droitwich, ironically enough, was found least effective where it was most needed to offset Regional dissatisfaction. In North Wales and in the South-west of England fading and night distortion were seriously affecting reception of the Droitwich National signal.

Deputation after deputation has had its effect on the Big House pundits. But all the deputations in the world would not have brought any real hope of solution. It is the unexpectedly high degree of success of synchronisation of London, West and North Nationals that has pointed a way out.

A common tuning fork controls in a very rigid manner the wavelength of 261·1 metres now shared by the three "little Nationals." They are connected together by line, and the variation between one and another is exceedingly small. So small that, with a reduced power of 20 kilowatts apiece, these stations provide a reasonable service in their respective areas. Three large centres of population served, it should be noted, by only one wavelength.

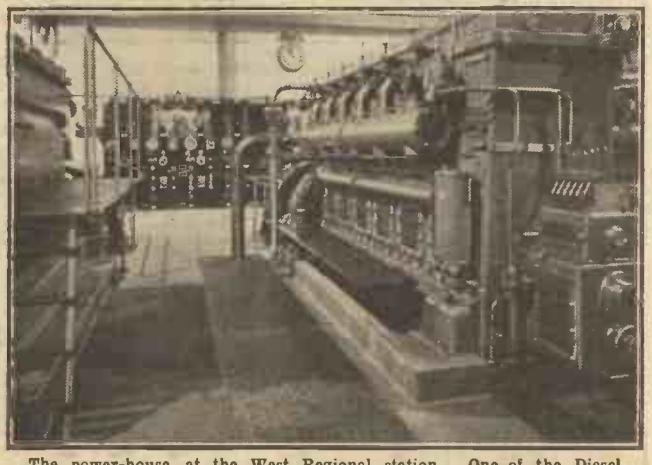
"For the first time," runs the B.B.C. statement on this matter, "it seems that there is a prospect of being able to operate further stations (projected or under construction) in this way."

Qualified in every possible way—for the B.B.C. loathes jumping its fences before it reaches them—a prospect is held out of a separate station for the West Country. This being made possible by further synchronisation experiments—upon stations wisely not yet specified.

The basic idea is to turn the proposed 5-kilowatt station for Plymouth into a full-blown Regional of 20 to 50 kilowatts. This in itself would not cover the whole of the populated West—much less the whole of the West itself. So a relay is proposed for the Bristol district.

These key points of South Devon and North Somerset would enable the major part of the West to be given a reasonably good service. It is emphasised that even with these stations every listener in every part of the sparsely populated areas of the West might not materially gain. As always, it is the greatest good for the greatest number.

AT THE WEST REGIONAL



The power-house at the West Regional station. One of the Diesel engines can be seen on the right, and, in the background, part of the power switchboard.

The Bangor Station.

The existing West Regional station at Washford would then be turned over to Wales, devoting itself exclusively to Welsh interests. It is a vindication of engineering policy that Washford is still the ideal site for serving the greatest area of South Wales—but then that was never seriously questioned by those who knew the facts.

What of North Wales ? The B.B.C. never pretended Washford would be any good there. It hardly hoped that even Droitwich would reach it on the long waves. Conscious of the extremely poor service the North Wales listeners were getting, the B.B.C. long ago promised them a relay.

And this is where Bangor comes in. As I mentioned a short time ago in this journal, a studio is already under construction there. Added to this will be a low-power relay, which will serve perhaps the

(*Continued on page* 338.)

SPECIFIED ...and with good reason... FOR Mr. SCOTT-TAGGART'S

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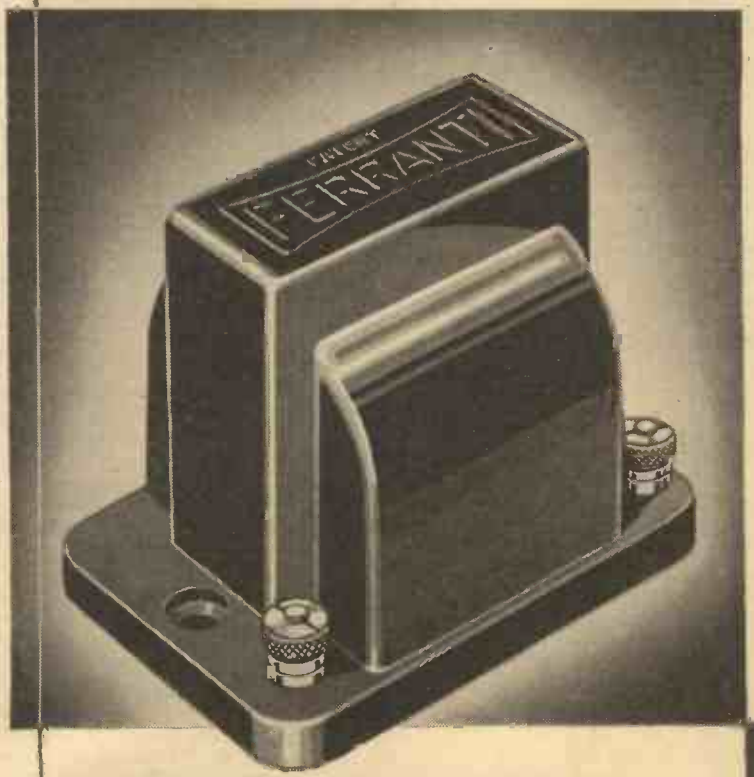

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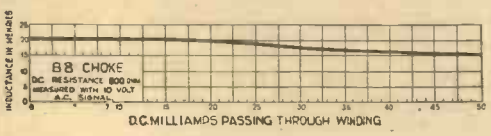
THE B8 CHOKE

A really efficient low priced smoothing choke with high inductance maintained under load conditions. Price, each **8/-**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THE GH ·5 RESISTANCE

The element is comprised of graphite deposited by a special process on a rod of refractory material. It is enclosed in well-finished bakelite case fitted with massive moulded-in terminals.
They are accurate to within 5% of their rated values, absolutely silent in operation and are specially designed for general de-coupling purposes. Their inductance and capacity are negligible. ½ Watt type.
Dimensions ⅜" d. x 2½" l., obtainable in the following values. Sizes up to 250,000 ohms. Price, each **1/-**
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13 Years of PROGRESS

THE thirteen years which have elapsed since POPULAR WIRELESS was first published have seen some striking changes in radio technique. In 1922 there were probably not more than a hundred thousand listeners, and the vast majority used crystal sets and headphones.

Something of the complete newness of broadcasting during that year is evinced by the fact that the description "complete," as applied to an advertised receiver, meant as a matter of course that aerial and earth equipment were included.

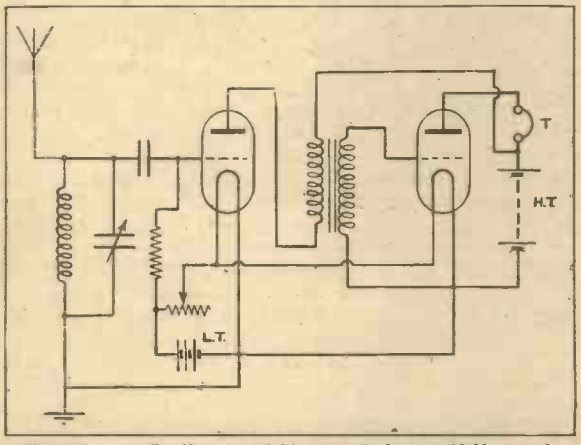
It is interesting to note that in the third number of "P.W." appeared an advertisement of Messrs. Peto-Scott, who, in their announcement, said: "We are the pioneer firm to specialise in sets of parts for any type of wireless apparatus." No truer statement of fact can have ever appeared in print, for that first quarter-page Peto-Scott advertisement initiated a happy co-operation which ran through the years right up to the present.

"P.W." 1922–1935

What wonderful advances in radio technique, and what astonishing reductions in prices of wireless apparatus have taken place in those thirteen years! Some surprising facts are given in this interesting article

By G. V. DOWDING, Assoc.I.EE.

AN ARISTOCRAT OF 1922



Simple tuned coil—filament brightness control—no grid bias—and phones. Such was this "last word" 1922 circuit.

What a Price!

One of the main subjects of advertisements in those days was sets of parts for building variable condensers. Practically all constructors did that. For a condenser of ·0005 mfd. the vanes and frame cost 14s. The case and bevelled ebonite dial were listed at 4s. 3d. and 3s. 6d. respectively.

Twenty-one shillings and ninepence for a single variable condenser which you had to assemble yourself!

The coils used were mainly rather large cylindrical types. Later came lattice and honeycomb multi-layer types. But we do not think any of these attained anything like the popularity of the basket coil. For a year or two it was almost a craze, and basket coils became comparatively cheap.

Home-made Coils.

Even so, many constructors preferred to make their own. They used to use a gadget something like a wheel with removable spokes and no rim. The wire was wound round in and out of the spokes, and these were removed when the correct number of turns had been wound on, leaving a coil that had the appearance of the lid of a small wickerwork basket. Thread was employed to hold the turns in place, although, in the factory-made ones, the whole affair was often buried in paraffin wax.

The price of a valve was 22s. 6d. At least, that was the ordinary three-electrode type which you used for all purposes. H.F. amplification was hardly heard of, though, and the most popular valve set was the one-valver for headphone use; later an exclusive few installed two-valvers with squeaky little loudspeakers.

The valves were mainly bright emitters. That is, they ran with their filaments at almost white heat and emitted enough light to read by. The current consumption was in the neighbourhood of three-quarters of an ampère at 6 volts, so a two-valver would quickly run down the type of accumulator that is used to-day.

In the later months of 1922 a dull emitter made its appearance.

The Dull Emitter Arrives.

It was a valve which could be run from a 2-volt accumulator, and it took only ·18 ampère. But the price was 50s., which is about ten times as much as you pay to-day for a valve ten times as good!

Bright emitters had a run of several years before they were eventually completely displaced.

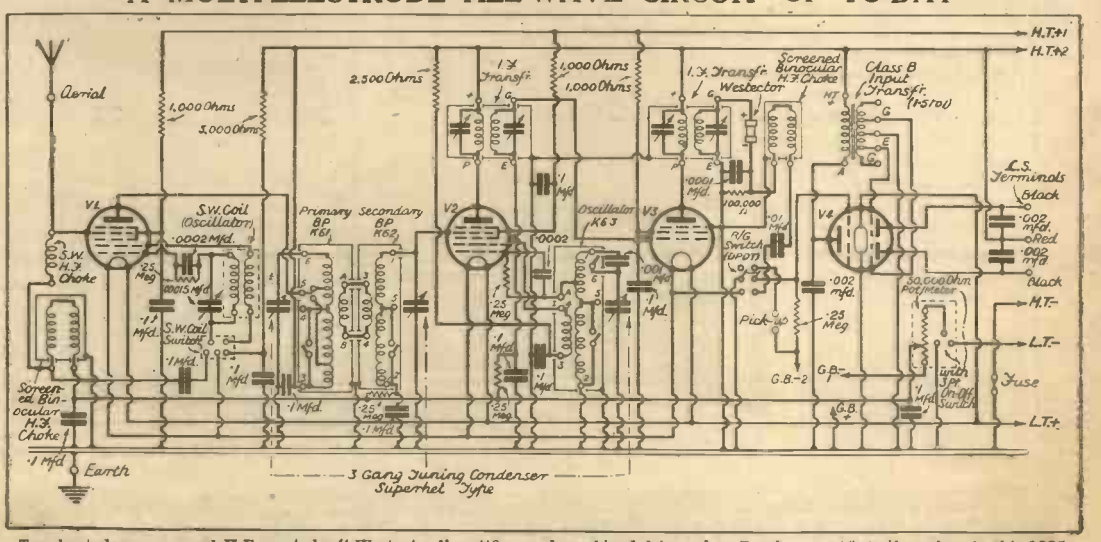
On this page you will find an interesting couple of circuits. One is of a 1922 two-valve arrangement which, it is to be noted, was an aristocrat of its day. Only the radio élite possessed a set employing such an "advanced" system.

One can but admire its stark simplicity. As you will observe, there is no grid bias for the output valve. But nobody except the most finicky of engineers bothered about grid bias in those days!

But what you do find in that prehistoric circuit, which very seldom appears in modern battery sets, is a filament resistance. You had to adjust the brightness of your valve filaments with this, and if you increased the illumination too much the life

(*Continued on page* 340.)

A MULTI-ELECTRODE ALL-WAVE CIRCUIT OF TO-DAY



Two heptodes, a screened H.F. pentode, "Westector" rectifier, and combined driver-class B valve constitute the valves in this 1935 design. In addition, the set uses iron-cored coils, a superhet circuit, and covers short, medium and long wavelengths. Short-waves were practically unknown thirteen years ago.

TELEVISION

CHOOSING THE BEST TUNING ARRANGEMENT

SOME NOTES ON THE VARIOUS METHODS OF COUPLING AVAILABLE—THEIR ADVANTAGES AND DISADVANTAGES

By L. H. THOMAS

MOST of my remarks on the subject of television receivers have been concerned with the ultra-high-frequency part of the circuit; this, in a way, is the most important part of all, since, without successful operation here, nothing that follows it is any good.

It is, however, one of the most simple parts of the circuit to get going well. Almost anybody can make a successful "sound" receiver for ultra-short waves, but the "vision" portion calls for a complete revolution in all one's ordinary ideas of set building.

In the April 13th issue of "P.W." I described one type of intermediate coupling that has been used with good results. This consisted of a tuned transformer, with both primary and secondary heavily damped by means of parallel resistances.

A Wide Response Curve.

In actual practice such an arrangement has been found to give a response curve that may be said to have a width of nearly 2 megacycles, although, of course, that does not mean that it is flat for all that bandwidth. To give some actual figures, a single I.F. stage of that type, working on a frequency of 7·5 megacycles, is substantially flat from 7·2 to 7·8 megacycles, and between 6·7 and 8·3 megacycles the variation in response is not more than 25 per cent.

Three such stages give a reasonably high degree of gain, but require careful adjustment. Furthermore, it is not the kind of adjustment that the average home constructor is equipped for, involving, as it does, the use of a valve voltmeter and standard signal generator.

We have several alternatives available when we start designing our intermediate-frequency amplifier, and it would be as well to compare two of them straight away.

Obviously it is possible to obtain a wide response curve by two completely different methods. One is to use a number of stages, *each* giving a very flat curve, on the lines of those already referred to. When this method is used it is important to realise that the curve will become *sharper* as one adds extra stages, and that the overall response of a single stage must therefore be much wider than that required for the entire amplifier.

The Band-Pass System.

The type already mentioned should be satisfactory, as it is capable of a wide range of adjustments—not only the resistance damping, but the L/C ratio of each circuit.

The other method is our old friend the band-pass circuit. In this case a number of circuits, each comparatively sharply tuned, are employed. The peaks of the individual circuits, however, are "off-set," so that the sum of their effects is not one larger and sharper peak, but a fairly flat-topped curve.

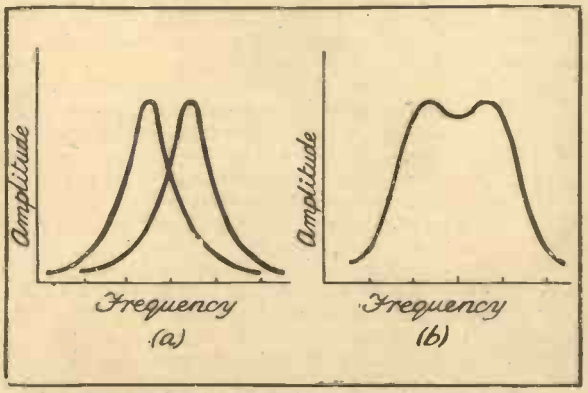
The diagram gives a very rough idea of what happens when two stages, suitably tuned, are used. It is just the familiar "double-hump" effect, and the introduction of a third stage, peaking at a frequency in between those of the other two, would give a curve that looked still better.

As soon as regular transmissions start, transformers of both types will be readily available, and should only require very small readjustments to compensate for stray capacities and other circuit constants.

In both cases the frequency used for the intermediates will be fairly high, because this makes it a simpler matter to obtain the large band-width that we require.

Yet another method is the use of a large number of aperiodic stages, coupled by a combination of resistances and chokes. The stage gain will be fairly small, but three or four stages can be handled very easily, without the risk of instability or the need of making tricky adjustments.

THAT DOUBLE-HUMPED EFFECT



These diagrams show the type of tuning curve given by two "off-set" stages. In (a) we see the two individual curves due to the separate stages, and in (b) the effect of combining them.

In my own receiver I am developing a system that is a compromise between the two, using special intervalve couplings that are tuned roughly to the required frequency by the external stray capacities only. This gives a very poor degree of selectivity, but a much higher gain per stage than the true aperiodoc coupling.

Anyone who has listened on the short waves with a set of commercial coils will have come across one obvious fact. Suppose you have two coils, one covering a range of 49–75 metres and another 31–50 metres. The latter will give really easy operation on the 49-metre band, whereas the former will be almost unworkable. If one has a really efficient tuning condenser with a very low minimum and a loosely coupled aerial it is possible to obtain tremendous signal strength by using the larger coil, but selectivity will be almost non-existent.

Coils cut so that they tune to the desired frequency by their own self-capacity only form a very simple type of intervalve coupling for a television receiver, and I am hoping to develop a very successful receiver on these lines.

Not Really "Low" Frequency.

Needless to say, problems of screening will arise in this part of the receiver, and extreme care must be taken with the wiring and layout.

When one has finished this particular job one is confronted by another—the design of suitable L.F. stages, still capable of passing frequencies up to 1 megacycle or more.

One can hardly allude to them as "*low*-frequency" stages any longer. We are not concerned with the necessity of obtaining a large power output, since the cathode-ray tube is a voltage-operated device; and the simplest and most satisfactory plan is to use resistance-capacity coupling, with special precautions against loss of top and "super-top."

It is hardly practicable to use triodes at all, since their internal capacities are sufficiently high to ruin the frequency response at the top end. H.F. pentodes, however, are very convenient for the purpose, and can be used quite successfully.

When my own experimental work is a little further advanced I hope to give full details of suitable arrangements of this part of the circuit.

It hardly seems likely that the average home constructor will have the necessary equipment for lining up his own apparatus, since it is by no means an easy matter to measure either the band width passed by the I.F. stages or the response of the L.F. stages.

Careful Copying Essential.

From this it follows that the original designer will have to use more than ordinary care in providing a layout that can be very accurately copied. There is no reason why a really careful copy of the receiver that *does* work should not give equally good results; but, from what I know of the home constructor he is sometimes a little apt to allow his own ideas to creep in. They may be good, but their effect upon the performance of the set may not be so!

Meanwhile, however, the designers are getting along.

SOME VALUABLE ITEMS

Details of the range of Bulgin valve-top connectors, and a compact Eddystone wavemeter for use on the short waves.

BULGIN VALVE CONNECTORS.

THE transition period that always accompanies a change is sometimes rather annoying. You have a good example of what we have in mind in the screened grid valve. Formerly this was always fitted with a terminal at the top of the bulb, but recently a plain boss has been adopted.

This is undoubtedly a change for the better because the boss permits the use of simple and perfectly satisfactory clip-on connectors. What is rather irritating is that one's S.G. might or might not have a boss; there are plenty of the terminalised varieties still about.

However, Messrs. A. F. Bulgin & Co., Ltd., of Abbey Road, Barking, Essex, have, as would be expected, a number of gadgets which can smooth away the trouble entirely.

At the small cost of 2d. they will supply you with an adaptor (list No. P.68), which screws on to old-type valves and enables them to accommodate any of the new clip-on connectors. The adaptor is

FOR GOOD CONTACT

From left to right these are the Bulgin screened valve connector, the connector for valves with a terminal top, and the boss conversion adaptor.

threaded internally and merely screws on to the valve's terminal.

You can also convert one of the bosses of the new types of valve into a straightforward terminal if you want to do that, and this can be done with the aid of the Bulgin P.66 adaptor, which sells at 3d.

Of course, Messrs. Bulgin have clip-on connectors for the bosses. The simple uninsulated type to which the flexible lead must either be clamped or soldered is sold at the rate of three for twopence. This is listed as the P.41 connector. P.43 is a similar type of connector but it costs 1d. and is fitted with an insulating shroud.

In addition, there are two types of screened connector. These are fitted with frosted aluminium cowls which enclose the whole affair, including the soldering tag for the lead, a clamping lug for the shielding or braiding of the lead being brought out as can be seen in the photo.

The two models are list No. P.64, which is of standard depth, and list P.65, which is shallower, so that when it is placed in position it will not make contact with the metallising of a valve. This is often desirable, for in some circuits the grid bias could be short-circuited were the valve metallising to be earthed inadvertently by a connector shield. The price of either of these models is 6d. each.

All the adaptors and connectors we have dealt with in this article are well made, neat devices which fulfil their purposes admirably.

A SHORT-WAVE WAVEMETER.

IF you want to tackle short-wave reception seriously, then a closely calibrated wavemeter is a necessity. Without one you are working in the dark. It is true that the relative positions of various of the stations can be found on the dial of a receiver fairly approximately after you have managed to obtain a few identifications, but there are so many short-wave stations and they come in in such compact bunches that a hit and miss procedure of that nature is far from being entirely satisfactory.

Then, again, there is the construction of coils. A simple matter, but a wavemeter is necessary to test ranges. In searching for stations a wavemeter can serve in either of two ways. It will enable you to set your receiver correctly for a given station which you want to pick up, or it will enable you to identify stations quickly by wavelength.

Hitherto, the cost of a calibrated wavemeter for short waves has been prohibitive to the average constructor; but now Messrs. Stratton & Co., Ltd., of Eddystone Works, Bromsgrove Street, Birmingham, have produced a first-class one at three guineas.

Messrs. Stratton are, of course, short-wave specialists, and they have been manufacturing high-grade short-wave components at reasonable prices for a long while. And it is obviously this experience which has enabled them to produce a wavemeter of high quality at a relatively low price.

It is an extremely neat little unit, and is hardly larger than many of those combination volt-current meters. It is built into a die-cast metal box, and is of very robust construction. Close readings are possible with the dial, which is of generous dimensions, and a point of some real practical value is that the dial, while being easy to set, is moderately stiff in its movement.

Therefore, a setting remains "put" even although the meter may be quite roughly handled. There is nothing so irritating as a wavemeter whose dial tends to swing away from its setting if it is accidentally touched.

The wavemeter can be used either as an absorption meter or as a buzzer radiating type. The buzzer is switched on and off by means of the small

QUITE SMALL

The Eddystone S.W. wavemeter is but little larger than a multi-range voltmeter.

switch which can be seen just above the dial in the photograph. The buzzer circuit is also made and broken by the coil, which plugs in so that when there is no coil in position the buzzer cannot be working.

The buzzer is of the high-pitched variety and gives a clear note. The incorporation of a special rubber mounting reduces the mechanical noise to practically inaudibility.

Three coils are provided and these enable the wide range of from 9·5 to 220 metres to be covered and clear calibration curves for them are given on the one convenient sheet.

Using the buzzer the Eddystone wavemeter throws out a strong signal which, of course, can be reduced to any degree by distancing the meter from the set. Naturally, it is rather broad, but invaluable for rapid location of rough settings. Using the instrument as an absorption wavemeter, however, all that anyone needs in the way of sharpness is then available. Adjustments of the meter are possible to half a degree on the dial, and with the aid of the calibration chart very fine wavelength readings can be obtained.

TELEVISION JOTTINGS

How the amateurs are helping things along.

ALTHOUGH we are frequently told that the Americans regard our television plans with awe and wonder, it seems that our friends across the water are not exactly falling behind. This thought is occasioned by a glance at the latest official list of American short-wave stations, which includes 15 television transmissions below 7 metres, 6 in the region of 100 metres and 6 between 150 and 140 metres.

Opening the Way.

The two ultra-short-wave bands allotted in the States are roughly 5-7 metres and 3·5–5 metres, with just a narrow gap for the 5-metre amateur band in between the two. It looks as though the 5-metre "hams" will have to justify their existence if they hope to keep the band that they have pioneered so nobly.

Once more, in fact, I suppose it is safe to say that it has been the amateur who has opened the way for television. Would anyone have played about with the ultra-short waves at all if the amateur hadn't been let loose on them first? I wonder.

"Electron-camera" technique in the U.S.A. seems to be going ahead at a tremendous pace; other systems of transmission hardly seem to be considered at all. The Zworykin Iconoscope and the Farnsworth "Image-Dissector" have already been briefly described over here, but they seem to be regarded in the States as mere links in a complete chain of equipment.

One sphere in which the amateur has been able to help is that which concerns aerials. From our old friend the simple dipole have sprung a tremendous number of variations, each of which seems to possess some exclusive advantage which is denied to all the others.

One particular system that is now being widely used employs a vertical mast of metal which serves as the main radiator. This may be carried in an insulating mounting at the top of the highest convenient building, feeders of almost any length being carried up to it from the actual transmitter. Obviously one of the main troubles with any television transmitting station is going to be the acquisition of a sufficiently high site for the aerial; but in New York there is no lack of high buildings, and the optical range from the top of the Empire State Building, for instance, is extremely useful.

Remembering the extraordinary results obtainable with very low powers and poor aerials, one cannot help thinking that the range of a high-power transmitter with a good aerial must be far in excess of the figure of 25 miles that is usually quoted. As a concrete example I may quote this: I know an amateur transmitter who, with an aerial with an effective height of 35 feet and an input of 3 watts, regularly covers a distance of 22 miles. I'm not saying that he puts a "picture-strength" signal into the other end or anything like it, but with 100 watts he probably would.

Considering that the commercial television transmitters are probably going to use a power not far short of 20,000 watts and aerials with an effective height of 500 feet at least—well, draw your own conclusions.

New Short-Wave Aerial.

A new type of receiving aerial, by the way, is also being developed, its chief advantage being that it gives a much wider response curve than the ordinary resonant di-pole type, without suffering from a loss of efficiency.

I understand that a fairly regular television transmission on ultra-short waves will be available to experimenters before very long. This is good news for those, like myself, who have receivers nearly ready and are breathlessly awaiting something on which to test them. The only criticism that I have to make is that this should have been going on for months.

Best of all, I understand that there will be more than one high-def. transmission in the 10-metre amateur band before very long.

L. H. T.

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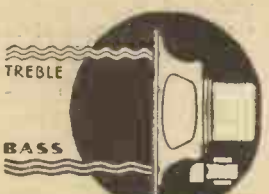

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ON THE SHORT WAVES

"LONG-PERIOD LOGS"

This week W. L. S. gives some details of readers' research work on the reception of distant short-wave stations.

QUITE a few years ago I asked readers who were interested to keep watch on one of their pet stations for a few weeks and to let me know the results. Several readers did so, and the comparisons between their findings were very interesting, but didn't get us far, because they all took place at different times of day!

More recently I have been asking for volunteers who would undertake to keep a log over a period of three months or even longer, and I had a splendid response. Furthermore, some of them obviously kept their word, for their logs are beginning to come in. As a matter of fact, one of them (from R. J. A., of Holloway) is reproduced right on this page.

I am immensely interested in the logs that are coming in, but it is just about as hard for me to draw conclusions from them as it is to understand the whys and wherefores of local conditions.

How, for instance, does one set about it when one wants to compare these logs? One has been kept on W 8 X K (19·72 metres) between 4 and 4.30 p.m. every day for three months (November to January). The other on V K 2 M E, Sydney (31·28 metres), every Sunday afternoon at 2.30 in the three months January to March.

Actually there are only four days common to the two logs—the four Sundays in January! But others kept on Sydney, fortunately, are also arriving.

A Remarkable Cycle.

Just look at R. J. A.'s log on this page and note the remarkable cycle, with a period of about six days. It seems far too definite to be an accident, and I shall be interested to see how the curve carries on for another month or so. My own log concerns conditions on the amateur bands, and there is not the slightest suggestion of this six-day peak about it.

I can trace distinct peaks in connection with the 15-monthly and 7½-monthly periods of the sunspot cycle, and also peaks due to the phases of the moon; but all other variations appear to be quite irregular.

K. B. (Bournemouth) has sent in a log incorporating quite a good idea. He has simply plotted a curve showing the *average* strength at which American stations were heard during a period of a month. His curve, too, shows a peak every six or seven days.

Perhaps someone would check up this for me. K. B. quotes the *worst* days during March as the 2nd, 6th-8th, 13th-16th, 21st and 26th. The *best* appeared to be the 1st, 9th, 17th-20th, 25th and 28th, the latter being best of all. My own amateur-band log shows the 18th and 27th as the best days during the month.

What is the Point?

By now you will probably be asking, "What's the point in all this?" Well, there certainly *is* one. Someone, some day, is going to make a discovery which will straighten up this "conditions" racket. It is incredible that we should always be at the mercy of short-wave conditions. The commercial concerns, of course, know quite a lot about them, and when one channel is giving unreliable service they just shift to another wavelength.

Furthermore, they know, as a result of past experience, which wavelength is likely to be the best for that particular occasion. It's no good getting individuals to keep these long-period logs unless there's a certain uniformity about the procedure.

Therefore will those who are interested enough to keep on with them please note the following: Keep your log on any station you like; keep it at the same time every day, and if you have to miss a day now and then please leave it blank—don't fill in some other time, as you will upset the whole thing.

Don't change your aerial or receiver during the period of the log, and don't rely too much upon your ears for the strength of the station. Of course, I know that everybody can't do things in a really scientific way—on the contrary, there are very few amateurs who can. But there *is* such a thing as a calibrated volume control, which will give you an "R" scale that doesn't change in accordance with what you've had for breakfast!

Simply take a signal that corresponds with your idea of, say, R7. Rotate your volume control until he is *just* inaudible, and mark that point "7." Then repeat it on an R9 signal, which may still be just audible with the control at zero.

An "R1" station will probably want the volume control all in (and then some). With the figures 1-9 on the panel and a nice arrow knob, you should be able to stick to a perfectly good scale of signal strength, although, even then, it is entirely dependent upon *your* idea of the "R" scale.

The Official Code.

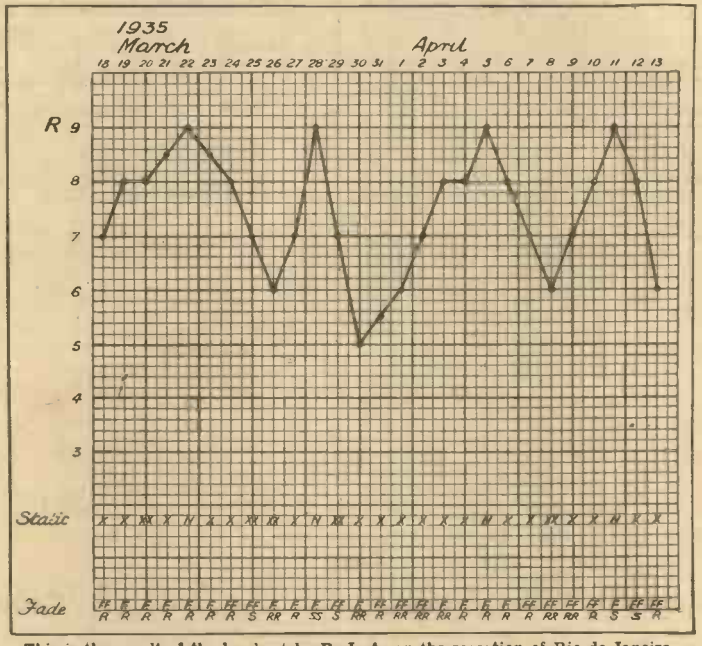
For your guidance the official designation nowadays is as follows: R1, faint, just readable; R2, weak, barely readable; R3, weak, readable; R4, fair, easily readable; R5, moderately strong; R6, good signals; R7, good strong signals, readable above any interference; R8, really strong; R9, extremely strong—colossal!

Try to stick rigidly to that, and then we can start comparing one log with another.

The point I am keenest on settling is the difference in the daily variation of conditions noticed at two points—one in the south and the other in the north of this country.

Conditions in London are quite different from conditions in Birmingham, but there *must* be some connection. Sometimes they are the same; sometimes there is a lag of an hour or perhaps a day. Amateurs, by sheer weight of numbers, can do their part in straightening matters out.

AN ENTHUSIAST'S RESULTS



This is the result of the log kept by R. J. A. on the reception of Rio de Janeiro, Brazil (wavelength 31·58 metres). Note the six-day cycle periods when the volume peaks to its maximum.

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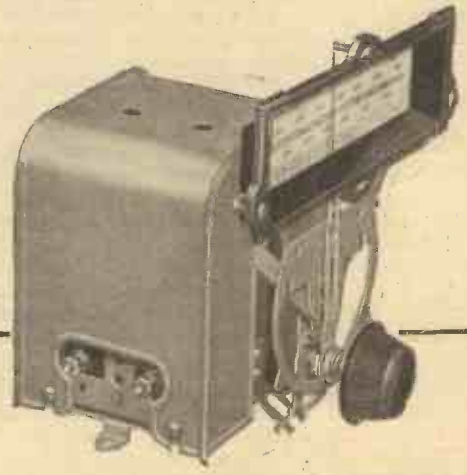

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6914

ON THE SHORT WAVES—*Page 2.*

ANSWERS TO CORRESPONDENTS

W. L. S. Replies in Brief.

THE post-bag is overflowing, and "potted replies" must be the order of the day.

C. B. (Long Eaton).—No, I haven't published a diagram of my own transmitter, but a picture and a certain amount of "talk" appeared on page 249 of the May 11th issue. Your O N 4 Z Q is a Belgian station; you got hold of the "Quebec" idea from his phonetic announcements—"Z Q as in Zanzibar Quebec." Sorry to disappoint you!

Uses for Micro Waves.

J. W. (Oadby, near Leicester).—Yes, it is a fact that micro-waves are being used to improve the growth of plants and vegetables, and also to kill vermin; but I can't find any definite information about it. I know, however, that I read a lot about it in an American monthly magazine.

T. T. P. (South Shields).—Yes, your circuit is all right, and it should "gee" with a crystal in place of the tuned circuit, but the H.F. pentode, as it stands, would not work as a frequency doubler as well as an oscillator. A nice place to break the circuit for keying would be in the suppressor-grid lead.

F. W. (Saltash).—Yes, I expect it was K R G M, as several readers have mentioned him of late. Others take note—K R G M, Manila, Philippine Islands, may sometimes be heard on about 19 metres during the afternoons. Telephony, of course. Thanks for photo, F. W.—I'll see what our artist says!

W. M. (Llanelly).—Considering the other results you mention, I shouldn't think you need worry because you can't hear an African station. Africa isn't exactly thickly populated with short-wave stations; but if you persevere in the early and middle evening you will surely hear Nairobi on 49 metres one of these days. I believe he's been pretty weak lately. After all, if you get Sydney regularly on the speaker there's not very much wrong with your "B.C.L. Two-cum-Three."

E. J. E. (Ipswich).—Glad you took my advice about theoretical circuits and can now follow them easily. Now you want coil data! Well, you can make coils of any size or shape that occurs to you, so it's a little difficult for me to give turn numbers for various wavelengths. Next week, however, I *will* give turn numbers for "valve-base" coils wound on standard formers, which are easily the most popular type today.

AN AMATEUR STATION

This neat receiving station is owned by Mr. W. W. Warner, of the I.D.A., at Exeter. Note the Q.S.L. cards on the wall and the compact short-waver in the foreground.

R. J. A. (Holloway).—Many thanks for the log on P R F 5, which, if all has gone well, is reproduced on the previous page. Yes, I entirely agree with you about the ghastly telephony from certain foreign amateurs; but what about the terrible stuff we hear from certain commercials? Lightships, trawlers and even Air Force stations put out signals that would send an amateur to the guillotine straight away. *Some* day, I suppose, all this will be put right.

G. H. (Bristol).—Yes, differential-reaction condensers seem to have been given a rest in short-wave sets. Personally, I've never found them worth while, and I'm one of those lucky people who manage to get perfect reaction control by other means! You're right—telephony from New Zealand and Australian amateurs is pretty scarce; I don't think they are keen on long-distance phones, or perhaps their Governmenta regulations introduce some difficulty.

Learn to Read Morse.

J. E. (Leeds).—Yes, shipping-band listening is quite interesting these days, though it's not everybody's meat. Fewer and fewer listeners seem to learn Morse these days. But it is a thrill to hear real "DX" signals from a ship. No, I don't know where Discovery II is at present. Can any other reader enlighten us?

H. J. B. (Manchester).—Thanks for your "come-back." I like your idea of passing a short-wave adaptor round your circle of friends in the hope of converting one or two—all good for trade! Yes, 20-metre conditions are marvellous just now—you should hear the Hawaiians (K 6's) in the early mornings.

J. C. (London, S.W.1).—Cards for American amateurs may be sent to A.R.R.L. Headquarters, 38, La Salle Road, West Hartford, Conn., U.S.A. Thanks for your log, and glad to hear you've got back to the short-wave world once more.

SNOWED UNDER

A day in the life of a busy service man during the recent Jubilee celebrations.

ONE would hardly credit that so many sets could all go wrong at once. True, our little village is packed to the attics with receivers of all descriptions, and in the surrounding countryside many more lurk in dark corners waiting to pounce on the unwary service man, but the avalanche took me completely unawares.

All through the day a steady trickle of callers. "Can you come and see our wireless? It's stopped." Usually the message is delivered by a small boy, whose knowledge of the facts leaves much to be desired, but whose inventive powers are highly developed. Taking no chances, one fills a case with a complete breakdown gang.

A Little Reshuffling Necessary.

The owner of an ancient 3-valver has treated it to a new set of valves—alas! without result. Both grid—plugs are lying on the window sill, accumulator + and — reversed, and H.T.+1 and 3 transposed in the battery. A little reshuffling works wonders, and luckily the valves have suffered no apparent damage.

The next "repair" proves delightfully simple. A twiddle of the cone speaker knob, and Droitwich rolls in. Infants are sent hurrying and scurrying in all directions to secure for love or money G.B. batteries, accumulators (full), and H.T. batteries. One man is in despair. His set hasn't worked for three weeks.

A little questioning, and one is on the trail. A broken-down transformer. His joy is unbounded when one appears from the depths of the magic bag. At the moment it is worth its weight in gold to him, but I accept silver and pass on to the next invalid.

Another Problem Solved.

As I emerge I am waylaid by a local dealer, who has been frantically tracking me down, and hurried by main force to his "emporium." The box of tricks on the counter forms the background of a lively discussion between my friend and an irate customer. The customer disposed of, the box of tricks fortunately decides to give up its secret. Still more fortunately I have a spare component which will carry on temporarily.

I leave the dealer looking decidedly more cheerful, promising to call in later armed with soldering bolt. Decide a spot of dinner would be welcome. As I come in sight of the house I experience a sinking feeling. Two motors are parked outside the door. I peep into the wireless "den" and get a shock.

On the floor are three sets. I step into the dining-room and discover two more, accompanied by their attendants—one a particularly evil looking specimen. The set, of course, not its attendant. The lads can offer no suggestions, being merely carriers, but a brief note informs me that the "super" is "very heavy on grid bias." I test valves and fixed condensers and decide to try it out. It plays beautifully and its consumption seems normal.

Then a happy thought strikes me. Can he mean the G.B. battery runs down quickly? A test discloses a decided short across the battery—a permanent short, for switching off makes no difference. I Discover a lead from the potentiometer moving arm touching an earthed wire. Raise the lead; the short disappears. Switch now cuts off the G.B. Make a mental note for future reference, and tackle another patient.

The Grand Finale.

All this takes much longer to do than write about, and at last I decide to call it a day. With a sigh of relief I turn to my own trusty set. Switch on; a flash, and the fuse has "blown." Of course I have been fooling around with the valves, testing doubtful "tubes" on actual signal strength comparison. I straighten up a wire, which, like myself, has grown weary and is reclining against the metal coating of a valve. Replace the fuse, and all is well.

E. O'M.

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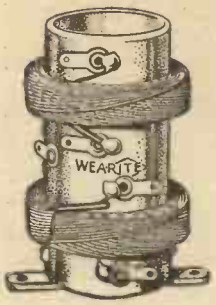

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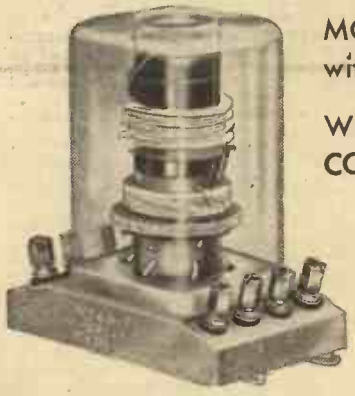

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All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

INSERTING VISUAL TUNING ON AN OLD MAINS SET.

C. L. D. (Oxford).—"Mine is an old model mains set, and with only occasional valve replacements it has been going perfectly without attention. So I do not feel like laying out on a new one, though I admit there is one great advantage in these later sets from my point of view. I refer to *visual* tuning.

"The worst of the superheterodyne circuit seems to be the fact that if the tuning is not *exact* there is always distortion. And it is not so easy to tune exactly by ear—in fact, it is quite impossible to some members of the family!

"So I wondered if a milliammeter could be used? And, if so, how it should be wired into the set? I read of this possibility in 'P.W.' a long time ago, but should like further particulars if you think the scheme likely to be a success.

"I do not propose to put the milliammeter on the panel or alter the set more than necessary. So could I run leads out at the back of the instrument? And, if so, from what points? My milliammeter is a big-scale instrument, reading up to five milliamps, which I believe is what is required."

Visual tuning with a milliammeter should be easily fitted if your set employs an ordinary detector valve; but if this is *not* the case we do not advise you to attempt the job yourself, since you may do more harm than good.

If, however, one valve acts as detector, and is accessible, the probability is that you can easily insert the milliammeter in its plate circuit, which will give you a visual indication of the tuning adjustments.

What you have to do is to pull out the mains plug; undo the valve anode connection; join the anode terminal to the – terminal of the milliammeter; and join its + terminal to the lead that formerly went to the valve. Keep your new leads short and well away from other wiring. You will probably find the set works as well as before, but that as stations are tuned in the milliammeter needle alters accordingly. Exact tuning is denoted by the maximum alterations in the reading then obtained on the milliammeter.

CHARGING SEVERAL BATTERIES TOGETHER.

B. W. (Portsmouth).—"I wish you could explain a point about charging batteries which I am unable to understand. It is in connection with charging a number of similar units as used in H.T. accumulator installations.

"Supposing the charging rate of one of these units is a quarter of an amp. at a certain voltage. Then how should the rate be modified if, say, *ten* of these units, all alike, are joined together for charging?

"Is the rate increased ten times (in this case 10 x ¼)? And, if so, would not this be over-charging by giving a higher rate than is recommended for one unit?

"It seems to me that for ten units you would require ten times the charge of one unit. How is it worked out in practice?"

Your question is really several questions in one, but we think that the following statement of the principles involved will make the various points clear.

We quote from your letter: "It seems to me that for ten units you would require ten times the charge of one unit." That word "charge" is too vague, so substitute the word "power" for it and the statement is then a fair one. For charging ten units we require ten times the power of that required to charge one unit.

Power, in the electrical sense of the word, is the product of volts and amps. Increase either or both, and you increase the power. So, if we have to make a ten-fold increase, the question is whether we shall increase the voltage, or the current, or both.

The answer will depend upon how the unit batteries to be charged are connected together.

When Parallel Connection is Used.

If the batteries are joined in parallel with one another their voltage will remain that of only one unit; but their capacity—ability to deliver and take current—will be ten times as great as before.

So with the parallel connection they require the usual charging voltage as for one unit, but ten times the ordinary charging current. Since this will be divided equally between the units, they will then each be receiving normal charging current and voltage.

If the cells were, instead, joined in series with one another, the current passing through any one cell would pass in turn through all the others. So, in such a case, current can remain the normal charging value as for one unit, but voltage must be increased, because the opposing voltage of the ten units in series will be ten times that of the voltage of only one unit.

And, obviously, if some of the units were grouped in series with each other and then placed in parallel with other groups of units (in what is known as a series-parallel combination or grouping), the voltage current ratio could be adjusted accordingly, enabling each cell to receive the correct charging current at the proper charging voltage.

CURING PLOPPINESS IN A SHORT-WAVER.

M. P. (Bolton).—"It's right what W. L. S. said about the 'difficulty' of short-wave reception being all bunk. I got W2XAL first time of tuning on a perfectly straight Two (det. and transformer-coupled L.F.).

"I have borrowed this set from a chap who has gone abroad for a cruise (lucky blighter!), and the only thing I do not understand is the potentiometer's function. It is connected slider to grid leak, and ends to filament terminals on the valve holder.

"It does not control volume, but he said it improves reaction control. How should it be adjusted?"

If you got America first time we should imagine that there is not much wrong with your reaction control; but it may be useful to know how to cure a tendency to "ploppiness" with the potentiometer, so we give the full particulars of adjustment below.

Set the tuning condenser about half-way round, and then turn the potentiometer slider towards the positive end of its travel. (That is, to the terminal which goes to the L.T.+ lead.)

Choose a time when there is "little doing" in the ether on one particular band, and test the effects of reaction adjustment.

With the slider right round at the positive end you will probably find that reaction tends to be a little ploppy and the set goes into oscillation too suddenly. To cure this, turn the slider back by degrees, towards the negative end of its travel, adjust reaction as you go, to see what effect the movement of the slider is having.

You may find it advantageous to alter the detector H.T. voltage as well, the object being to keep the slider as far as possible from the—terminal of the potentiometer while achieving perfectly easy and smooth control from oscillation to non-oscillation, and vice versa.

When a good position has been found, leave the slider set. It will need resetting only for a new valve or other altered circuit condition.

MEASURING A CHOKE'S D.C. RESISTANCE.

A. M. E. (Thirsk).—"Among the fruits of a visit to a sale of junk I obtained a big L.F. choke, the only marking on which is '300.' (I am hoping this means 300 henries, because I can do with one of this value).

"It works quite O.K. as an output choke on a det. 2-L.F. set with super-power valve, but it seemed to result in a slightly different tone from that given by the choke normally used on that set. So I want to measure its D.C. resistance to make sure that there is nothing unusual in this.

"Can I measure it reasonably accurately with a milliammeter and battery? And, if so, how?"

Yes, you can get a very close estimate of the D.C. resistance with ordinary battery and milliammeter.

Connect the instrument in series with the choke, and then the current passing through it from a two-volt accumulator will enable you to work out the resistance from Ohm's Law.

To protect the milliammeter we should switch in the battery through a variable resistance, arranged so that it can be cut right out when it appears certain that the milliammeter is on the correct range for obtaining the desired reading.

Thus the complete connections will be as follows: One side of choke to milliammeter; other side of milliammeter to variable resistance; other side of resistance to battery; other side of battery to remaining terminal of choke.

Try the milliammeter on its 10-milliamps range, and then (if necessary) on its 5-milliamps range, and cut out the resistance slowly until it becomes clear, at the all-resistance cut-out position, that the milliammeter is not going to be overloaded.

Having thus ascertained that it will be safe to take the reading on that range without extra resistance in circuit, remove the variable resistance altogether, or leave it in the no-resistance position, and note the exact reading obtained through the choke alone.

If the battery is neither quite newly recharged nor running down its voltage will be almost exactly 2. And this figure, divided by the *amperes* indicated

(*Continued on next page.*)

NORA WILLIAMS, the popular American stage and radio star, is a keen wireless enthusiast. She is here seen listening to a programme on her Cossor receiver.

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

on the milliammeter, will give you the choke's resistance.

Suppose, for example, the milliammeter reading is exactly 5. Since milliamps are thousandths of an amp., this is 5/1,000ths, or ·005 amps. Divide this figure into the voltage, 2, and you have

$$\frac{2}{\cdot 005} = 400.$$

The resistance of the choke, therefore, is 400 ohms in this example. And other values of resistance can be obtained in exactly the same way from the milliammeter readings.

TESTING FOR A CRACKLE.

S. D. L. (Greenwich).—"I've got the 'Silver King' going magnificently, but I don't deserve it, because I took one or two small liberties with components and rushed the wiring. However, it goes grand, except for a crackle, which I blame on my hurried wiring. How can I test it, to find out whereabouts the crackle is being caused?"

You can try out the "Silver King" as a simplified two-valver by removing the J240 valve and connecting the aerial lead to the 3 terminal on its valve holder. With reaction you should get clear reception of the "local" stations, and if a period of listening to these gives no signs of the crackle you can assume that this is caused in the preceding part of the set.

FITTING A FUSE TO THE S.T.600.

A. S. (Leicester).—"The 600 is going like a 6,000, but having been brought up 'careful-like,' I should like to fit a fuse to it. Where does Mr. Scott-Taggart recommend it to be placed?"

The most satisfactory position is in series with the H.T. negative lead at the point where this lead is connected from the battery's negative socket to the actual H.T. negative plug. For this purpose the ideal fitment is a wander-fuse, in which the fuse is incorporated in the H.T. — wander-plug itself.

IS THE WEARING OF 'PHONES HARMFUL?

"REGULAR READER" (Near Widnes, Lancs).—"I am writing to you about a problem I have thought over for a very long while, and I am afraid I can find no solution to it. The problem is this: Does the wearing of headphones, using a battery-operated wireless set, affect the nerves of the body through the ears and cause nervous trouble in the body?

"I know that this is not strictly a wireless query, but I thought you would be able to judge whether you had heard of a similar case, you being in touch with persons who must use headphones for long periods in their work. I have not got an output transformer in this battery-operated wireless set of mine, which I suppose keeps the electricity out of the earphones, and I wondered whether I suffered through the electricity playing on the head via the 'phones."

We think you can safely dismiss the possibility of any such effect occurring. From the technical point of view the currents flowing are so small that it would seem impossible for them to harm even the most delicate nervous system. And similar currents, but many thousands of times stronger, are acting year in and year out upon wireless engineers in transmitting stations without causing the slightest harm.

From the medical point of view, too, there is every evidence against any harm arising, since virtually all hospitals are fitted with radio apparatus. If 'phones were harmful the effect would certainly have been noticed long ago. But, as you probably know, the evidence is all the other way, and the beneficial results of wireless have been so widely remarked that it is becoming known as "Dr. Radio." In any case, the currents do not come out of the 'phones and reach the head. They are confined to the 'phone circuit, and only the sound reaches the head and ears.

RATTLES WHEN ADJUSTED TO LOUDEST VOLUME.

G. P. R. (Clewer, Windsor, Berks).—"I am interested in J. B. B. of Swindon's remarks in your issue of 'P.W.' May 4th—'A Loudspeaker Fault that Wasn't.'

"Having built the S.T.600, using correct components, I have had a rattle from the first time switching on. Six speakers have been tried. Finally a Rola was purchased, but still the rattle on loudest notes.

"Other valves of the same type have been tried by my dealer, and the set tested. The only way to prevent the rattle, which is distortion, is to keep the set below the volume which one wants.

"I have been advised to use a pentode in the output, and I may mention the batteries are O.K."

As the only way in which the rattle can be prevented is to keep the volume below a certain level, you appear to have a clear indication that the rattle is due to overloading.

It is evidently not the speaker, since you have tried half a dozen different ones. And while the use of a pentode might possibly help matters, you would run a serious risk of L.F. instability troubles due to the large amount of L.F. amplification you would then be obtaining.

Remember that the *quality* obtainable from the S.T.600 is as good as can be attained with the valves employed; and despite the great range of the set there is nothing in it that impairs quality as compared with other sets.

But the *volume* can never exceed the power-handling capacity of the valves; and that is why owners of the S.T.500 (which is somewhat less sensitive, but has *larger power-handling capabilities*) were advised to retain that type of set if their chief requirements comprised not only good quality, but also very loud reproduction.

In other words, the available volume from the S.T.600 is not so great, and was not intended to be so great, as that from the wonderful power-handling circuit of the S.T.500. But whereas the S.T.500 can only give its owner full benefit on the limited number of stations that give a strong input, the S.T.600 gives its full volume from a very large number of stations.

Most people find this volume sufficient, or more than sufficient. But in those cases where a still greater volume is demanded a different type of set, with a greater power-handling output (such as the S.T.500) must be used.

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1 Colvern S.T.600 Ferrocart "Extractor" Coil	8 6
Set of 4 Specified Valves	3 6 0
1 Rola P.M. moving-coil speaker	1 15 0
1 Peto-Scott A.C./D.C. S.T.600 Cabinet	1 10 0

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S.T.600 A.C. Version

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Set of 3 Specified Valves .. .. .. £2 : 13 : 6

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1 Set B.T.S. short-wave plug-in coils, type T.P.	10 6
1 Formo 2-gang coil unit, type A.H.	10 6
Set of 3 specified valves: 220VS, 210HF, 220PP	1 5 0
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See overleaf for full instructions

IS SYNCHRONISATION THE SOLUTION?

(*Continued from page* 326.)

most populated part of what is, after all, a relatively unpopulated area.

At the same time, we have on the tapis some very important additions to the B.B.C.'s network, North Scottish, North-east Regional and North Ireland Regional being the most significant.

Under the recent rearrangement of British wavelengths the way was prepared for the coming of the last two named. For North-eastern Regional on Newcastle's improved wavelength of 267·4 metres. For Northern Ireland Regional on Belfast's improved wavelength of 307·1 metres.

Commom Programmes Essential.

As I understood the plan, North Scottish would have obtained the released wavelength of the odd "little National." Now that these are seemingly staying on indefinitely it is a little difficult to see where the new Scottish station's wavelength is coming from—unless it shares.

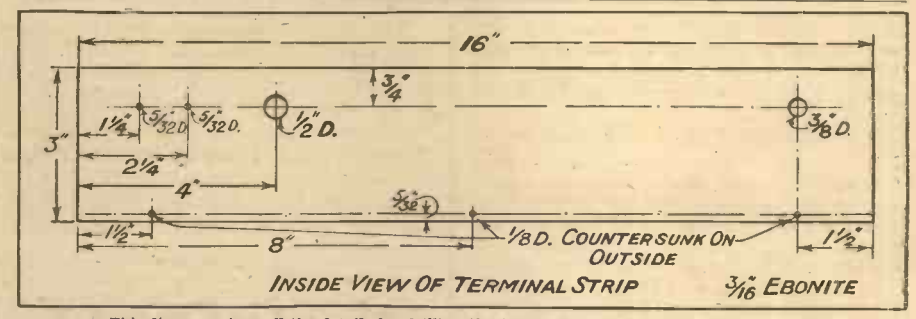
That brings me to another point. Synchronisation of stations as close together as any two or three stations must necessarily be in this little island kingdom is possible only so long as they do the same programme.

Is there some sinister intention to "common" some of the Regionals—for in no other way can they share a wavelength? Unless they send out the same programme, existing or projected Regionals must have separate wavelengths.

One obvious station waiting to be relieved of its wavelength is Scottish National. Not a bad wavelength, either. It is 285·7 metres. I imagine it was left alone in the general reshuffle as a sop to Scottish Nationalism—at a time when there did not seem much hope of giving the North a separate Regional.

Somewhere in this layout there is a missing wavelength, unless all my calculations are out. And unless I have an ultra-sinister turn of mind it looks as though the upshot of it all will be a loss of genuine Regional programme alternatives.

Meanwhile, I advise you to watch this synchronisation tendency. It has programme implications too dire for me to dwell upon at this early stage.



This diagram gives all the details for drilling the terminal strip of the A.C./D.C. S.T.600.

THE A.C./D.C. S.T.600

(*Continued from page* 322.)

Complete the connections between the two chassis and to the loudspeaker.

Fit all knobs and cover all grub screws with wax, or cover with insulating tape, otherwise shocks from the grub screws may result.

Insert the valves in their correct positions and fit the anode clips to the two H.F. pentodes.

Drill two holes in the back board of the cabinet for the mains plug and one hole to permit the toggle of the on-off switch to protrude.

Fit the back, seeing that the mains plugs do not touch the wood of the back. Connect aerial and earth. Plug in mains plug. If on D.C., and no sounds emerge from the speaker after a minute, reverse mains plug.

The set is now complete and working.

J. S.-T.

The A.C./D.C. S.T. 600 Valves

V 1	V 2	V 3	V 4
Mazda VP/1321 met.	Mazda VP/1321 met.	Mazda Pen. 3520	Mazda U 4020

A.C./D.C. S.T.600

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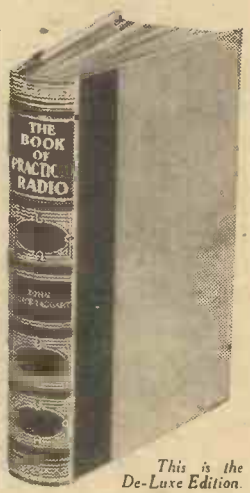

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This is the Standard Edition.

"LISTENERS DON'T LAUGH ENOUGH"

(*Continued from page* 324.)

I could mention several others, of course. The comedian's lot is indeed a hard one. Perhaps the hardest of all broadcasters, as broadcasting is a terribly hard task-master.

* * *

Mr. Murgatroyd and Mr. Winterbottom are supplying a much needed want. It is precisely their sort of humour that we want. So far they have been able to avoid any repetition. But can they keep it up? "What's a Grecian urn?" asks one of these gentlemen of the other. The other replies, "That depends on how hard he works." This is the last thing on the air I really laughed at, and that was ten days ago at the time of writing.

* * *

The Chinese Syncopators were a novel turn. Theirs was very accurate and precise playing, and their style was very different from any other syncopated combination that I know. At times the effect they produced reminded me of a barrel organ. I am glad I heard them.

A Good Feature.

Joe Loss and his band score mainly by offering a bigger variety of numbers than most other bands. They seem to use a bigger assortment of instruments, too. Another thing I noticed about them was that a solo instrument often accompanies the vocalists. This is a feature I strongly approve of.

* * *

It speaks well for a talk when it provokes subsequent discussion. I have heard the series on diet by different doctors being discussed in many quarters. There is no question about the interest that the series has aroused. Actually, I didn't hear the talk on "Food for the Average Man." But I have heard all about it since. The thing that seems to have appealed most to listeners was the simplicity of the language used, when technical language might have been expected. I heard the talk the previous week by the lady doctor. Such talks must do an inestimable amount of good.

* * *

The annual gesture of the Welsh children when they broadcast messages of goodwill, with a reminder of their responsibilities, to other children of the world seems to me an essentially sound thing. If children can grow up and then continue to live in this spirit, the world must become a better world and fit for anybody to live in.

Creating Mutual Sympathy.

These goodwill items are a common feature of B.B.C. programmes, and indeed of many foreign broadcasting companies. There are several of the sort being done at the moment; for instance, "The Empire at Work" and "From the Four Corners." These talks must create a mutual sympathy between folk following a better understanding of one another. Broadcasting is doing wonders in this respect.

* * *

Sadler's Wells finished its season with a Gala Night which was full of jollity and light-heartedness. The second act of "Die Fledermaus" was broadcast. The audience was in a very merry mood, and this was shared by listeners at home.

* * *

Studio "parties," which are becoming popular, aren't the easiest things to run. They sometimes lack spontaneity. I recall a Christmas party once that was excellently done. Then there was "Jack Barty's Party," which was perhaps a bit forced. The happy-go-lucky spirit of the "Jubilee Party" was a success chiefly because it *was* happy-go-lucky.

C. B.

DOES THE ETHER EXIST?

(*Continued from page* 325.)

issue of the "Philosophical Magazine," he talks of the possibility of carrying it out again in much the same way but with a very much more powerful magnetic field. You see, the difficulty in producing a powerful enough magnetic field along which the ether might drift at a measurable speed is enormous. Thousands of turns of thin wire on an electro-magnet with an enormous current flowing would be necessary, and the heating effect would be such that the wires would melt, thus ending the experiment catastrophically!

Sir Oliver therefore suggests keeping the wire so cold—by liquid air, for instance—that it could carry 1,000 ampères. Even with this powerful equipment he estimated "the ether flow along the line of force will be only three millimetres per second, or 7 inches a minute—about a snail's crawl. This is the speed which has to be compared with the velocity of light."

Using Liquid Helium.

How could it be done? Not at all until the right apparatus could be produced, and apparently in his laboratory at Cambridge Professor Kapitza had in recent years developed the right technique. Moreover, he had something better than liquid air for obtaining low temperatures—liquid helium, which by a liquefier developed by himself he could produce quite easily.

"You must understand," Sir Oliver told me, "that Kapitza's apparatus has produced greater magnetic forces than any other. What he wanted to do was to use this magnetic force to produce, as it were, a whirlpool in the ether. The two rays of light would then be sent round the whirlpool in opposite directions. If the speed of the light in the two directions varied, then Kapitza would have done a wonderful thing and showed that the moving ether had speeded up the light that travelled with it or slowed up that in the opposite direction. Now, of course, the experiment will have to wait; after all, it does not matter—it can be carried out later on. But I should have been very, very interested in the result."

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1 S.T. 600 Ferrocart "Extractor" coil - 8/6
1 Volume control 50,000 ohm - 3/6
1 Tone control 50,000 ohm - 3/6

Once again Colvern is the choice of Mr. Scott-Taggart—this time for the A.C./D.C. S.T. 600. Here is further convincing evidence of the all-round superiority of Colvern components—they are pre-eminent for the pin-point accuracy and efficiency demanded by modern radio. Ask for Colvern components — as specified — and be certain of getting the finest possible results.

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BROADCASTING IN YUGOSLAVIA

By CECIL W. LUSTY

YUGOSLAVIA, which has lagged behind in broadcasting developments, is now becoming radio conscious, and in a recent tour of that vast country I learned much concerning the programmes that will later be made available to British listeners. The Director of Radio Belgrade, M. le General Kalafatovich, informed me that the Radio Belgrade A.D. Company, which is 98 per cent British owned, would be spending upward of £100,000 on broadcasting developments. As announced in POPULAR WIRELESS, a modern 50-kw. station is nearing completion a few miles outside Belgrade, and 6-kw. transmitters will be built at Skoplje and Serajevo. Radio Zagreb is being pepped up to 20 kw.

Short and Medium-Wave Stations.

I first visited the Radio Belgrade studios and offices in the stately Knez Mihailova structure. At the time of my visit the transmitter, which I found to be an exact replica of our old 2 L O—familiar rectifier, drive oscillator, power amplifier and modulation stages—was housed here, but it has now been moved to the site of the high-powered station. Belgrade, it is not generally known, has also a short-wave station, U N 7 R B, which is on the air from 1 a.m. to 3 a.m. (Central European time). I was rather surprised to hear that the 2·5-kw. medium-wave Belgrade station had been well received not only in England and North Europe, but also in Africa, America and India.

BELGRADE'S "BIG HOUSE"

Yugoslavia's Broadcasting Headquarters in the Academy of Science Building, Belgrade.

There are several studios with celotax walls, the largest being 23 feet by 35 feet. The electrical musical box in the control room has two octaves, so that, if ever necessary, the interval-signal melody can be changed. This musical box was designed by the station's engineers. Belgrade has a radio orchestra of sixteen players, and for relay purposes there are permanent lines to opera houses, concert halls and cathedrals.

Belgrade, as a rule, transmits from 11 a.m. to 1.45 p.m., 4 p.m. to 5.20 p.m. and 7 p.m. to 11 p.m. or midnight (Central European time).

13 YEARS OF PROGRESS

(*Continued from page* 328.)

of your valves would be a shorter, if brighter, one.

Now glance at the 1935 POPULAR WIRELESS circuit. It is that of the all-wave superhet which we recently described. As you can see, there isn't one single three-electrode valve in it, whereas in 1922 there were nothing but three-electrode valves.

Two heptodes, a multi-mu H.F. pentode and a Class B valve! Count the electrodes in that team. Nearly enough for nine three-electrodes, aren't there? Phew! Phew! and again *Phew!* Progress sure has marched to some purpose. And there are other things tucked away in this four-valve circuit which were undreamt of thirteen years ago. A metal detector, for instance.

And yet it is to be doubted that the modern constructor gets more out of his radio than his brother of a decade or more ago. More stations, yes, but not more pleasure. When "P.W." started there was one British programme lasting for half an hour (on Tuesdays only), and about two

(*Continued on next page.*)

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13 YEARS OF PROGRESS

(Continued from previous page.)

Continental stations to tune in which worked for about one hour per week.

You didn't hear any criticisms of those programmes; they were waited for and hung on to as though they were angelic choirs broadcasting from Paradise!

Actually, the quality was unbelievably terrible, as can be imagined. General-purpose bright-emitter valves of any old characteristics, without grid bias and coupled by hedgehog L.F. transformers having the curves of the shape of elephant tusks—no top, no bottom and practically no middle! The whole coupled to a telephone earpiece stuck in one end of a tin trumpet, and styled, hopefully, a loudspeaker!

Yet it was so wonderful to be able to get anything at all that everyone thought it sounded grand.

The history of the development of radio reception reveals that practically all advancement has centred around the thermionic valve, and the landmarks are the three-electrode, the S.G. valve, the pentode and the heptode.

BARRY KENT CALLING

(Continued from page 324.)

interest in greyhound racing, and the annual "Derby" at the White City is also a social occasion, Royalty normally being in attendance.

But our ether rulers are having nothing to do with the dogs. It is laid down on the special instructions of Sir John Reith himself that dog racing is banned from all microphone reference. So that's that.

* * *

New Outside Dance-Band Policy.

Now that Mr. Gerald Cock is handing over the O.B. Department, Mr. Roger Eckersley, the entertainment chief at the "Big House," proposes to introduce some changes in the outside dance-band policy. There is likely to be a bigger range of hotel and restaurant dance orchestras.

* * *

Trouble at Tyneside.

I have at last discovered the key to the mystery about the attitude of the B.B.C. to Newcastle-on-Tyne. For some time there have been new premises in working order there and a separate wavelength, and yet the proportion of local programmes broadcast has been surprisingly small. It appears that the reason for this is that the B.B.C. is by no means sure of being able to leave Newcastle with its independent wave for more than a few months. There is another shuffle of wavelengths on the cards.

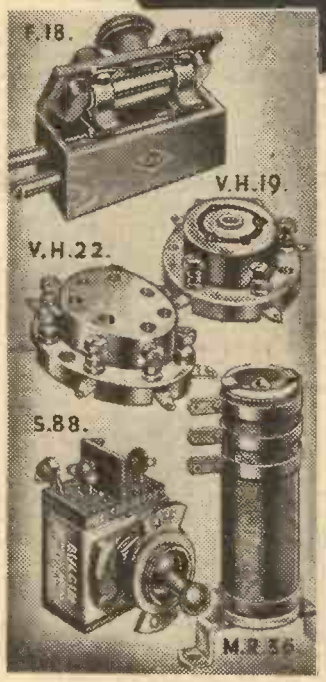
* * *

B.B.C. Changes.

Internal staff changes and reorganisations within the B.B.C. are of no interest to the listener unless they threaten to affect programmes. Sir John Reith is about to take a much more direct interest in programmes. This means that they will be strengthened on the serious side; in other words more talks and less entertainment. The opposite tendency has been at work for the past three years, and now the Director-General, with the approval and support of his Board of Governors, is going to correct the balance himself.

Mr SCOTT-TAGGART M.I.E.E. F.Inst P. Fel.I.R.E

has SPECIFIED



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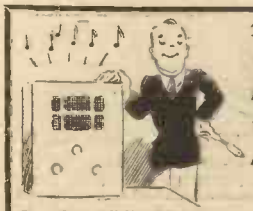

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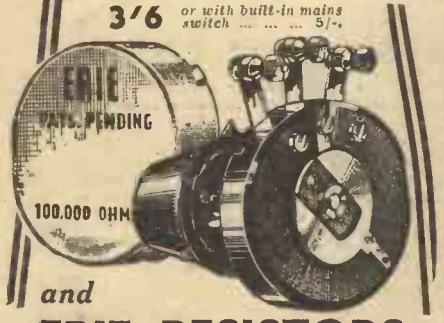

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ATTENTION to detail in the manufacture of components has been responsible for the success of many firms in the radio industry. Firms have come, and firms have gone, but when one surveys the present industrial panorama there are few organisations in existence to-day whose reputations have not been built up first and foremost upon reliability and service over a number of years.

And isn't it notable how the old names live on? Almost all of the firms who are thriving to-day are the ones who were in "on the ground floor" way back in the good old days of 1922 and 1923.

The firm of Bulgin, of whom I am thinking at the moment, goes back even further than that, and to-day it is a fact that it is one of the most highly respected firms in the trade. That is because throughout its history the firm has consistently pursued a policy of service to the constructor, and has never been inveigled into participation in "flash-in-the-pan" hazards which *might* have meant a fortune overnight, but which more probably would have spelt disaster.

Service to the Constructor.

Service to the constructor is the keynote of all Bulgin products, because it is the policy most deeply rooted in the heart of the man who actively and ably guides the destinies of the firm. I refer, of course, to Mr. A. F. Bulgin, whose boundless energy seems to have the happy knack of infecting all those who are privileged to come into contact with him. Little wonder that he has gathered round him a band of capable enthusiasts to whom the word reliability is their motto.

That is why you need never have any fears about a component bearing the name of Bulgin. And, believe me, I *should* know, for I have been over practically every component factory in the country at some time or other, and I know of no instance where greater steps are taken to ensure that all components leaving the works are absolutely up to scratch than is the case at the Barking factory of Bulgin.

I do not hesitate to stress this point—first, because I regard it as of such vital importance to all who are interested in home construction; and, secondly, because I believe that full credit should be given to any concern that places reputation on such a high level as Bulgin.

Incidentally, if you want a very practical proof of Bulgin thoroughness, take my tip and send for a copy of their catalogue and manual. It will cost you 3d., but it is a veritable mine of information and it tells you how to do all sorts of interesting things with your set. Address your applications to A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex, and mention "P.W."

* * *

So much absolute "bunkum" concerning television has appeared in print since the Television Committee report was published that I approach the subject with some trepidation in this essentially trade section of "P.W." for fear of being misconstrued.

Television is certainly coming, and it behoves us all to look forward to its advent with optimistic enthusiasm. But from the ordinary listener's point of view, the much-talked-of commencement of high-definition programmes in the autumn will not materially affect the present broadcasting position.

Tremendous Activity.

In the meantime, you will be glad to know that there is tremendous activity going on in practically all quarters of the industry, and when the time is ripe there are a number of surprises to be launched.

As may well be imagined, Cossors are well to the fore in the development of cathode-ray tubes, and they have already produced models which will render pictures approximating to black and white or sepia, and both of these tubes are available in 6¾ in., 10 in., and 12¼ in. diameters.

The pioneering efforts of such famous firms as Cossor are going to do more to hasten the perfection of fireside pictures than anything else, and I think we have just cause to be thankful that such eminent technicians are tackling the problem.

* * *

As I write these notes I am just off to Manchester (complete with umbrella) to witness the opening ceremony of Ferranti's gigantic new radio factory at Moston. If I am not too worn out when I have explored the 270,000 square ft. over which it extends, I will try and tell you all about it next week. In the meantime, here's wishing them the very best of luck in their new home. I'm confident it is going to lead to even greater things than those which have already made the name of Ferranti world famous.

G. T. K.

TECHNICAL JOTTINGS

Items of interest to all readers

By Dr. J. H. T. ROBERTS, F.Inst.P.

Trouble with a Radiogram.

THE other day I had trouble with a radiogram—one of those irritating little things that give such a lot of trouble and yet seem so difficult to locate. On the face of it, it was a very ordinary sort of thing and took the form of a lot of sizzling and crackling, sometimes getting very loud and completely spoiling reception. One naturally thinks, in these cases, of defective condensers just on the point of breakdown, or bad contact in the grid-leak, or a defective on-off switch, or something of that sort. All these things were carefully gone over, but everything seemed in order. What made it still more aggravating was that sometimes the set would work perfectly and then, without any warning, all this racket would suddenly set in.

Those "Accessible" Works!

The "works" of the set were very large and heavy, and so I put off taking them all out as long as possible, but eventually there was no alternative. When I got them all out I found that the trouble was in a vernier volume control, and, of course, as luck would have it this was fixed in about as inaccessible a position as it was possible to imagine. There was a reaction condenser nicely in the way, and the whole business was built up with screens on which condensers and other components were anchored. The first thing I had to do was to unsolder about a dozen connections before I could even begin to remove the screens. Having got these out of the way, I set to work to remove the offending volume control potentiometer, and then found that a transformer prevented this from falling out, whilst the holding-down screws of the transformer were almost impossible to get at, without standing on your head with a flash-lamp in one hand and a spiral screwdriver in the other.

However, after a good deal of bad temper and bad language, the potentiometer was removed. On examining it, I found that in springing on the aluminium cover at the back some small particles of bakelite had been chipped off and one of these had got under the slider. Naturally, I thought that on clearing all these out nicely and replacing the cover everything would be O.K. It was all put back, and all the soldered joints made up again and the screens put back in position, but the set would not utter a sound.

Shorting to a Shield.

It then dawned on me that the component was passing through a metal shield behind the front of the cabinet and, owing to the ebonite bush not being long enough, the case of the potentiometer was connected to earth by the hexagonal holding-down screw. There was no nice ebonite washer handy at the moment, so I quickly roughed out a washer from a piece of cardboard and fitted this and screwed the hexagonal nut

(Continued on next page.)

TECHNICAL JOTTINGS

(Continued from previous page.)

home on top. As soon as this was done the whole outfit worked absolutely perfectly. It was not the grain of bakelite inside the potentiometer at all, but one of the terminals of the potentiometer was being shorted to earth. So all my trouble in unsoldering all these connections and soldering them up again proved to be quite unnecessary.

I mention all this at some little length for the sake of any of you who may have similar trouble. It is a good plan, and one which I ought to have followed myself, to look for the faults as you go along instead of making any assumptions whatever. If I had very carefully removed the hexagonal nut and then noticed that there was no proper insulation between this and the earth shield behind the cabinet, I would have saved myself a great deal of time and trouble.

Buying a Second-hand Set.

I am frequently asked by readers whether they would be well advised to buy this, that, or the other kind of second-hand radio receiver. Usually the price is very attractive,

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and in some cases they tell me even that the set is absolutely brand-new—brand-new, that is, in the sense that it has never been used; sometimes it is in its original packing. This is all very well, and other things being equal the brand-new or unused set would be preferable to one which had been in service for some time. But it is almost impossible to advise anyone about a set without having seen it, and particularly without knowing the date and type.

You may have a set offered to you which was absolutely the last word, say, three years ago, and it may have been lying packed up and in stock and totally untouched since that time. Nevertheless, it would probably be a bad bargain to buy it now, because obviously such great improvements have been made during that time that it would be out of date.

Try It at Home.

One of the most important features to consider is selectivity, as with the ever-increasing number of stations on the air sets have to be made more and more selective. It is very doubtful indeed whether a set three or four years old, however good it might be in other respects, would really be sufficiently selective to meet all requirements of the present time, or whether it would compare at all favourably, even having regard to the price advantage, with a set of up-to-date design.

I think the best advice I can possibly give you is to have the seller of the set bring it and instal it in your own home, in exactly the conditions in which it is to be used, and then make a thorough test of it and judge it for yourself. If it satisfies you in these conditions, obviously there is nothing more to be said, but short of such a test I would not like to make any recommendations at all.

Cathode-Ray Systems.

There is a lot of speculation just now amongst amateurs as to whether, when television comes, it will be on the "electrical," that is, cathode-ray system, or whether the "mechanical" systems will get a look in. Hitherto, on the low-definition transmissions which have been available, the mechanical type of television receiver has had it all its own way. Many people seem to think that it is absolutely essential to use the cathode-ray type of receiver for high-definition reception, owing to the fact that, the cathode beam being weightless, and the method of scanning being entirely electrical, this system will be the only one able to follow the very rapid fluctuations which take place. This is quite a mistake, however, and there is no serious difficulty at all in making a mechanical type of receiver to receive high-definition television.

The Fluorescent Screen.

As regards the screen on which the picture is seen, some people have raised the point that the fluorescent screen is peculiar to look at and does not give any impression of reality, whereas the ordinary light-and-dark ground-glass type of screen used in some mechanical systems is much more "lifelike." This, I think, is a psychological point, and I do not think that much will be made of it when people get really used to seeing pictures on fluorescent screens, particularly the more or less black-and-white or sepia types of screen which have lately been developed specially for television purposes.

Mechanical Systems and Cost.

There is another point which most people seem to have overlooked, and that is the very important question of the relative cost of receivers of the two types. It is true that cathode-ray tube manufacturers have lately brought their costs down very considerably, and it will probably be possible later to get a first-class tube at a price of some £6 to £8. But even then some people will feel that the mechanical type of receiver has an advantage on the ground of cost.

It is impossible for anyone to predict how things will work out, but I think it is fairly safe to say that those people who believe that the cathode tube will have the entire field to itself will prove to be wrong. It may be that mechanical systems will gradually disappear, but I feel quite certain that they will not only remain with us for a time, but even be developed and improved for some years to come.

A Novel Earth.

A reader sends me an account of a rather novel type of earth which he has been

(Continued on next page.)

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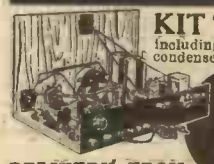

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TECHNICAL JOTTINGS

(Continued from previous page.)

using, and which he says gives very good results. As a matter of fact, it is not so novel in principle as he imagines, and it is somewhat similar to the "chemical" types of earth which are now so popular. Anyway, this is what he does.

He takes a large tin can, such as a cubical biscuit tin or, if available, a metal pail, and having dug a sufficiently large hole, buries this in the ground about two feet or more below the surface. The earth lead wire is securely attached, preferably soldered, to a convenient part of this vessel, and then a layer of calcium chloride is put into the vessel, the whole then being filled right up with earth. You will see that this is really little more or less than a glorified chemical earth.

A Moist Connection.

If the calcium chloride cannot conveniently be obtained, it is sufficient simply to fill in the vessel with earth and, as you will see, it acts in a way as a collector of moisture. In this, as in all other earth plates, the essential feature is to maintain effective electrical contact between the metal and the surrounding earth, and, of course, moisture is the best and simplest way of securing this. Anything which renders and maintains the earth in the immediate vicinity of the earth plate *moist* will assist greatly in preserving a good and efficient earth connection.

Double Speakers.

I wonder how many of my readers go in for double loudspeaker reproduction. There is a great deal to be said for it, and I think you will find that it will become very much more popular in the future. It would perhaps be going too far to say that it will become standard practice, but it has very definite technical advantages.

As you know, it is the aim of every loudspeaker manufacturer to make an instrument which will respond uniformly, or as nearly uniformly as possible, over the whole of the required audio range. This requirement imposes a very serious task on the manufacturer, which task is, however, greatly simplified if he can divide his problem, so to speak, into two parts.

"Natural" Reproduction.

In other words, if he is allowed to make one speaker for the lower register and a different speaker altogether for the upper register, the two will be in operation simultaneously and will be complementary to each other. A well-known and popular radio set on the market to-day uses a pair of speakers in this way, the reproduction from the same being described as stereophonic, a word which you will recognise as the acoustic equivalent of the optical term stereoscopic.

When you look through a stereoscope, using both eyes, at a suitable pair of pictures you see the result stand out in relief or "solid." In a somewhat similar way, if you use a pair of loudspeakers, properly arranged as regards characteristics and position, it is possible to get a much more lifelike reproduction; in fact, the term stereophonic is something in the nature of a brainwave.

Blaming the Transformer.

I was testing a small power transformer a few days ago for a friend, on the electric light circuit of his house. The instrument seemed to behave in a very peculiar way, in fact it refused to give any sort of output, and for a few minutes we were quite nonplussed. I should say that I had previously asked him if his electric-light supply was alternating current, and he had assured me that it was.

I must confess that for a little time I thought of such things as broken connections, rather than of D.C., but when after a bit I noticed the instrument getting warmed up, it occurred to me to ask him to go downstairs and verify the nature of the current by examining the meter. You can imagine that, in view of his assurance on this very fundamental point, I didn't like to suggest that he could have made such a mistake. Believe it or not, when the meter was examined it turned out that the current was D.C., and I think you will agree with me that no further explanation was needed to account for the "obstinacy" of the poor old transformer!

Awkward Components.

Have you ever noticed how awkwardly made some radio components are? You would think by now that manufacturers, being also experimenters, would have found out by practical experience all the little points which make for convenience (or otherwise) in the fitting of a component. For instance, sometimes a component contained in a bakelite casing, such as a choke or transformer, has only holes through the moulded casing for the fixing screws instead of metal eyelets or insets. The result is that, unless you are extremely careful when inserting the fixing screw, you will split off a piece of the moulding.

Having done this, especially if you do it at two adjacent corners, it is a matter of considerable difficulty to fix the component at all. The proper thing for the manufacturers to do is to put in a stout brass inset which will stand the racket of the screw being forced in. In any case it is a good plan for you to use a round-headed screw instead of a countersunk screw, as the former is less liable to cause trouble.

Splitting the Moulding.

Another point you often notice is that the fixing screws cannot be got at with a screwdriver without a good deal of difficulty, owing to the fact that there is some overhanging upper part of the component which gets in the way. With some of these accessories you would wonder whether the manufacturer had ever taken the trouble to fit one himself at all!

It is a good thing to note, however, that there has been a great improvement in these various points during the past year or two, particularly amongst the better-known types of British component. But you still come across odd ones—possibly they are foreigners; I don't know—in which this complete indifference to the convenience of the user is to be found.

Book of Practical Radio 4

Printed in Great Britain and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: John Carpenter House, John Carpenter Street, London, E.C.4. Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/6 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, June 1st, 1935. S.S.

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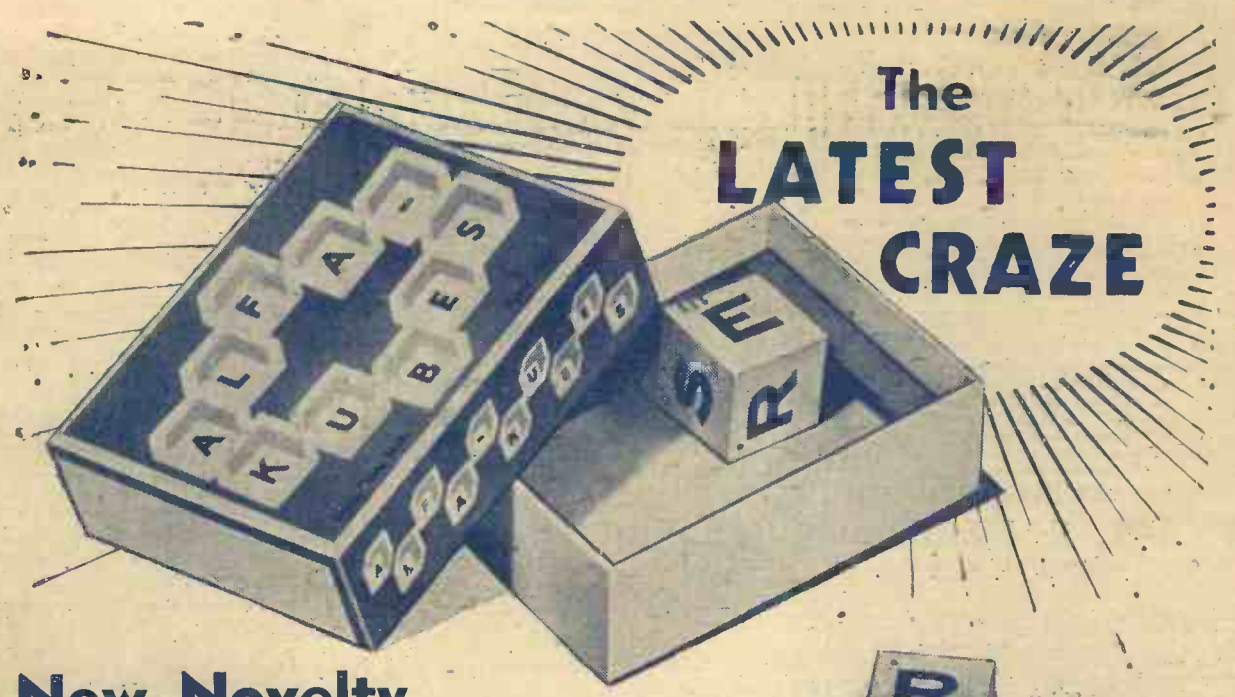

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Simple, isn't it? And you can see plenty of fun in the offing! What about those bad spellers? What about those who choose a five-letter word thinking that it will count more than one with four? It may not; it's the "pips" that score. See how it goes! Any number can play. It's a game that can be enjoyed at any time, both by adults and children. All the family can join in. It costs 1/- only, and the excitement and thrills you can get out of it will be worth that modest sum many times over. ALFA-KUBES will cast its spell on all who play it. Why not invest in a set to-day?

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No. 679.
Vol. XXVII.
June 8th, 1935.

HENRY HALL AS FILM STAR

Henry Hall, the popular B.B.C. director of dance music, is busy making a film with his band for British International Pictures, at Welwyn Garden City, Herts. This photograph shows Henry in the process of being "made-up" on the set in preparation for a scene.

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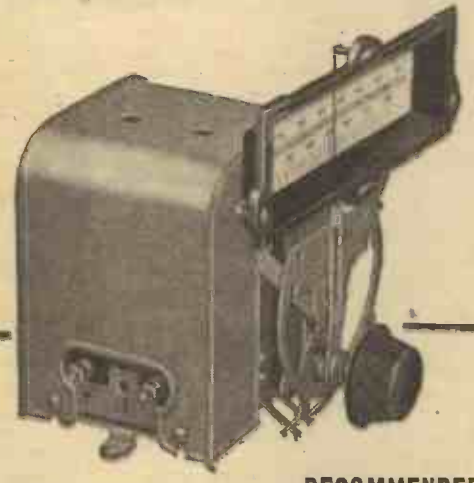

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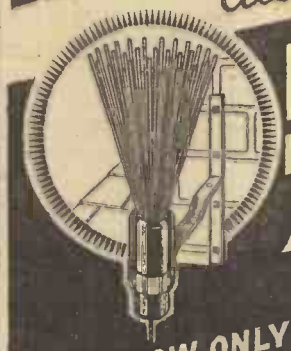

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I RAISED MY HAT
YOU'RE MORE THAN ALL THE WORLD TO ME
etc.

LEW STONE'S LIFE STORY

POPULAR MUSIC
and Dancing Weekly
EDITED BY JACK PAYNE

On Sale Thursday, June 6th, at all Newsagents **3d.**

POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR: N. F. EDWARDS. TECHNICAL EDITOR: G. V. DOWDING ASSOC. I.E.E

DR. RADIO
A SCHOOLS TEST
CONTINUOUS PERFORMANCE
MY TIP

RADIO NOTES & NEWS

THOSE "OLD MEN"
AMATEUR SHORTS
RADIO LIFEBOATS
IN 2035

Not All Honey.

THE terrifying experience of Mr. Thomas H. Holmes, a 26-years-old engineer employed at Belfast, proves that a job on the B.B.C.'s technical staff may not be all honey. When placing a microphone in position in the Belle Vue Zoo, Belfast, for a children's broadcast, he was badly mauled by a leopard.

The animal caught his coat and he fell beside the cage, into which the leopard tried to drag him. Mr. Holmes had his right leg severely clawed, but he was removed to the Royal Victoria Hospital, and recovered sufficiently to listen-in there to the broadcast for which he had been working.

On behalf of "P.W." readers I proffer hearty congratulations on this lucky escape.

Tonic Waves.

YOU would be surprised—and, I hope, grateful—if you knew the multifarious literature I wade through on your behalf to keep you in touch with radio developments the world over.

Hare-brained stuff, some of it, off-set by lashings of Proceedings, and Reports and Digests—the latter being particularly *in*digestible!

Recently, however, improving my mind with the *British Journal of Physical Medicine*, I came across a contribution on the healing power of very short waves, by Dr. R. G. Canti, pathologist to St. Bartholomew's Hospital, London, and scientific secretary to the British Empire Cancer Campaign.

He says, authoritatively, that our knowledge of short waves is in its infancy, but since research abroad has revealed curative effects in many diseases, investigation into their possible effect on cancer is warranted in this country.

My wealthy readers (yes, we have some financial giants among us!) might remember this research work when considering what to endow with their spare lucre.

Test Sentence.

"THINK how much pleasure it gives to tiny tots to sail their ships upon the Serpentine beside Peter Pan's statue."

The foregoing sentence is not intended to be taken literally, but I bring it to the notice of amplifier quality enthusiasts, because it makes such a grand test for loudspeakers. If your loudspeaker can do justice to all those p's, t's and s's, there is not much wrong with the reproduction.

According to the "Daily Telegraph" that sentence was evolved by the Approval Sub-Committee of the Central Council for School Broadcasting, to help them when selecting sets suitable for use in schools. Since scientific methods alone are not considered the ideal test, the Sub-Committee compares results on selected sets with those obtained from a standard B.B.C. receiver. Seems a good scheme, for if school broadcasts are to be of use, the sets used for it should be above reproach.

ON OTHER PAGES

Are Our Studios Big Enough Page 349
The Television Camera . . Page 351
How To Improve Your Quality Page 355
An Entertaining Novelty . . Page 360

P.M.G. and £ s. d.

AMONG my friends is a chap who buys tobacco—not in packets of twenty, nor ounces, but by the *hundred acres*, for one of the big tobacco firms. He has just come back from South Africa feeling very indignant.

It appears that his business compels him to call up various countries on the telephone when at sea. He is full of admiration for the wireless telephone service, but complains bitterly that it costs about twice as much for a sea-conversation with Britain as it does to speak with France, Germany, or other Continental countries.

Surely it is vital that our sea-going commercials should be able to call up Britain at least as cheaply as they can converse with her Continental neighbours?

TO-DAY'S BIG BROADCAST

R. C. LYLE, who will broadcast a description of the Derby to-day, June 5th. The new B.B.C. recording-van will pick up sound records of the event, to give colour to the news bulletin in the evening.

Never-Shut Station.

CONGRATULATIONS and a cheerful "Here's-mud-in-your-eye" to Sydney (2 U W), who works on 267 metres, and works, and works, and works. Sydney is not one of those chaps who idle their time away, for he claims to be the only station that is giving 24-hours-a-day, week-in, week-out, absolutely continuous broadcast service.

Some of the American stations believe in seldom-shut-eye tactics, and at least one European transmitter has run for several days without cessation. But 2 U W, Sydney, like Old Man River, just keeps rollin' along, to the tune of *tempus fugit*.

Good luck, and may you outlast all the sceptics, Sydney. You have one unfailing consolation—it is only a question of time!

Brevities and Levities.

SCOTLAND'S new station at Burghead is progressing rapidly.

* * *

Australian listeners smiled broadly when a commentator announced, in all seriousness, "I can't see my face in front of my hand."

* * *

Stalin, who has hitherto avoided the microphone, allowed his recent speech to the builders of Moscow's new underground railway to be broadcast.

* * *

An enthusiastic radio advertiser got a laugh when he advised his hearers, "If you go into a shop and ask for ——'s paint, and they haven't got it, insist on being served with it!"

The Undeviating Tip.

THIS is the season when everybody is looking for a straight tip. If you rather fancy the Short Wave Stakes, incline your ear in my direction. I have been examining the horse's mouth, and I have a cert. that deserves your shirt.

(*Continued on next page.*)

LISTENERS MUST HAVE GOOD CHARACTERS IN RUMANIA

"*Hexoverter*"—that's the name.. It is the *first* short-wave design for home constructors by John Scott-Taggart, and the stable that gave us the 300, the 400, the 500, and the 600 has once more produced a certain winner.

Invest a tanner in the June "Wireless," and get the inside information on "Hexoverter." He has the cleanest pair of heels on the course, and what a pedigree, boy! What a pedigree!

Amateur Announcers.

COMMEND with me the gentleman who has courageously suggested that amateur transmitters should pay more attention to the words they breathe into the microphone.

While admitting that much first-class experimental work is done upon the short waves, I venture to say that there is also an excess of self-conscious verbiage. In whatever district you live I guarantee that on a Sunday morning a short-wave search will give you the gentleman who says "Er—well, old man—that's all, old man—er—I'll try the condenser, old man—er, two o's one, as you suggest, old man . . . ."

Take out all those old men, and the unnecessary hums and ha's, and the short waves would glitter much more invitingly.

GREAT NAVAL REVIEW

Cruisers, aircraft carriers, destroyers, sloops, submarines, convoy ships, auxiliaries, torpedo boats, picket boats, ships of the mercantile marine, trawlers, in fact representative craft from every type which forms the British Navy, will be assembled at Spithead on July 16th, to be reviewed by His Majesty the King. Listeners will hear a commentary relayed from the decks of H.M.S. Royal Sovereign, where several microphones will pick up the Royal Salute fired by the guns, the music of the bands, and the cheers of the fleet.

The commentary will be given by Commander Stride, R.N., and Lt.-Commander R. Woodruffe, R.N.

Thrills for Listeners.

ONE of the most dramatic broadcasts on record was that from Kingsford-Smith's aeroplane "Southern Cross," when on a Jubilee flight from Australia to New Zealand. When a piece of exhaust pipe broke off and smashed a propeller, Capt. Taylor, the navigator, performed a prodigious feat in keeping the starved port engine supplied with oil which he took from the disabled starboard engine.

In stockinged feet he climbed many times out of the cabin along the wing till he could drain oil into a vacuum-flask. With this he clambered back to the cabin, and then along to the port engine, carrying out the feat time and again despite a wind pressure of 100 miles an hour.

Capt. Taylor, however, said the real feat of the flight was Sir Charles Kingsford-Smith's piloting.

O.M.s of the Ether.

ASKING me to put him wise about "this abbreviated Morse business," W. A. L., of Brixton, confesses that while he can approve of "O.M." standing for "Old Man," he sees no sense at all in such frequently heard short-wave terms as "X Y L" and "73's."

As a matter of fact, these amateur terms all have interesting roots. Since O.M. was used to mean Old Man, the married enthusiasts first tried "O.W." for "Old Woman." But the ladies themselves learned Morse, and properly demanded a more polite term. Hence X Y L, which means Ex-Young Lady.

"73's" is a very old term, borrowed from the cable men, and means "Good Wishes," "All the Best," "Cheerio," and that kind of thing. If, however, you get in touch with a station operated by Y L you may want to advance beyond the "73's" stage; if so, send "88's" to her—she'll know what you mean!

The World's Switchboard.

SIR KINGSLEY WOOD, our worthy Postmaster-General, has been casting a reflective eye upon the past ten years' progress in international telephonic facilities. In 1925, he finds, there were only four Continental countries to whom we could say "Hello." Now Rugby's trans-ocean telephone service has gained for Britain the proud title of the World's Switchboard.

As recently recounted, British telephone subscribers are now "on" to Japan. We cannot yet, however, speak at will to Shanghai, nor to Kenya, nor to Iceland, but our wide-awake P.M.G. hopes to rope in these places also by the end of the year, and has arranged for tests to be undertaken. Sir Kingsley would!

Impeccable Listeners.

WE sometimes grumble about red tape and bureaucratic methods, but we are lucky compared with the radio listeners of Rumania. Before you can get a receiving licence in that happy land you have to enter on a paper chase and fill in form after form, culminating in a certificate of character. This has to be signed by a priest, and unless he certifies that your character is almost as white as the driven snow you get no permission for radio reception. Knowing that I, personally, should never be able to qualify in such circumstances, it rejoices me to realise that neither would you, you rascals!

"Radio Normandie."

THE super-liner Normandie, when free of strikes on shore, ought to be able to strike a snag at sea with comparative equanimity, for she has no fewer than fifty-six lifeboats, I hear, and every one of them equipped with radio.

The equipment in each boat comprises transmitter as well as receiver, so the Normandie's wireless operators must have as much radio gear to keep in order as can be stored in a large wireless shop. This is a record, I imagine, and the wonder is they didn't call the vessel "Radio Normandie" while they were about it.

"RED SARAFAN" AGAIN

"The Red Sarafan," which scored such a success when it was first included in the programmes on May 7th, is due to be heard again on June 18th. The orchestra for this production is now a permanent combination, and will be heard in all the "Red Sarafan" broadcasts. It is proposed also to introduce various well-known artists, instrumental combinations and choirs. The book of the broadcast will be changed on each occasion. Emilio Colombo, the leader of the orchestra, is putting on paper from memory Russian folksongs and dances, some of which have not previously been heard in this country.

One of the features of "The Red Sarafan" is that most of the music will be exclusive to this Russian restaurant orchestra, as Emilio Colombo is the only musician who has the knowledge and gift to re-write the tunes that were popular in pre-war St. Petersburg.

Back from the Pole.

LISTENERS who heard the Antarctic broadcasts by U.S. Rear-Admiral Byrd, or by members of his expedition, will be interested to know that after nearly two years of exploration the party is back home in the U.S.A.

One man, unfortunately, had to be left behind in New Zealand, the strain having been too much for him. But the other members of the expedition had a real American welcome. As each stepped ashore his name was announced, and he was individually welcomed home by President Roosevelt, who is an old friend of Rear-Admiral Byrd.

A Century Hence.

THE American scientist, Thomas Midgley, has been speculating about life in a hundred years' time, when Mars has been made habitable to man, and indigestion has been eliminated.

He pictures the citizen of 2035 as able to control his age, becoming static at 20, 30, or 40, or whatever age he pleases. On rising in the morning this surprising descendant of ours takes a capsule of wake-producer, and throws his pyjamas away—because the hygienic clothing of 2035 can be renewed daily! He hears the stored-up radio news repeated, sees the overnight televisions, warms his house and has his food, all at the touch of the appropriate button. Since all life's little problems have been solved for him, he has nothing whatever left to curse—so I'll bet he doesn't half curse about that!

ARIEL.

The A.C./D.C. S.T.600

By JOHN SCOTT-TAGGART
M.I.E.E., F.Inst.P., Fel. I.R.E.

FURTHER NOTES ON THIS SENSITIVE ANY-MAINS RECEIVER

AT the moment of writing I am listening to my A.C./D.C. "six hundred"—with the volume greatly reduced, of course—and what a rich delight of sound it gives! How I would like to claim the credit for it all!

But, of course, I cannot. The brilliant realism of the reproduction is due, in modest measure, to some judgment in the combining of this and that; but to the speaker and valves goes the lion's share of the credit. Extreme sensitivity of valves permits a minimum of intervalve apparatus and thus the cutting out of sources of distortion.

The ultra-high grade of transformer—and I put such models as the A.F.3 and A.F.5 in this category—has not lost ground, but when cheapness is a serious consideration the usual run of transformer (which would have to be used) stands no chance at all in competition with a good resistance-capacity coupled stage.

The Detector-Amplifier.

Unfortunately, this simple arrangement gives no step-up effect and we have to rely on the valve preceding the resistance coupling to "do its stuff." Likewise, if we have only a single stage of L.F. amplification preceding the last valve, we must make that valve really sensitive.

In the ordinary way, one speaks of a stage of L.F. amplification when one has a separate valve acting simply and solely as a magnifier of the L.F. currents or E.M.F.'s. But in the present set—using such a convention—we should have to say that there is no L.F. amplification, which—as poor John Henry used to say—is all wrong.

There is actually very considerable L.F. amplification and it takes place in the H.F pentode, which—true to my battery "600" principles—I have employed as detector. Such a valve is really a combination of a diode rectifier followed by an L.F. pentode.

There is nothing frightfully good about the pentode as a detector pure and simple, but as a pure and simple L.F. amplifier there is a great deal to be said for it, and I am saying some of it now. The degree of amplification is considerable, which is why I considered this valve. But even the great sensitivity of the pentode would not be sufficient to feed, say, an ordinary triode output valve.

In the battery "600," colossal sensitivity is achieved—many times that of any other battery set of mine, for there is not only a pentode detector but a further stage of iron-core transformer amplification with its double merit of valve-amplification-cum-transformer step-up.

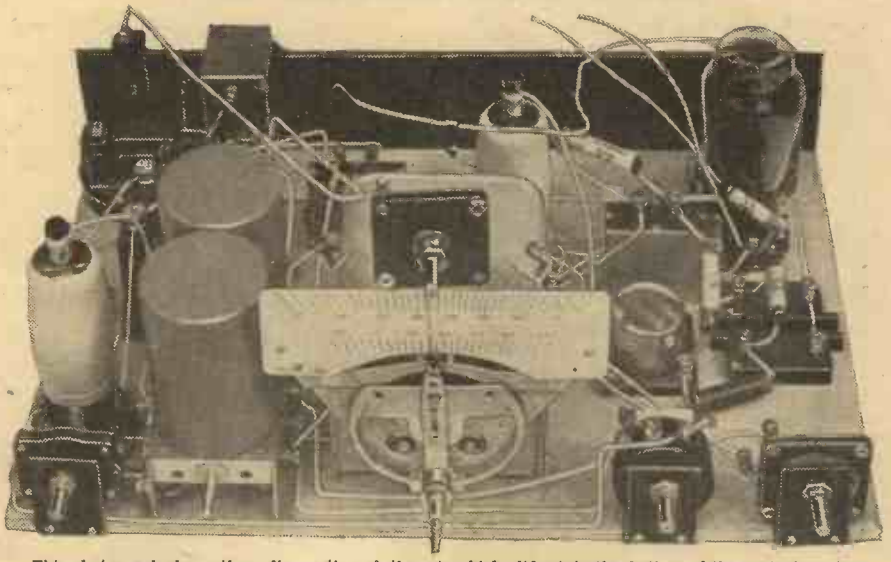
To approach this sensitivity with one valve less calls for more sensitive valves. The indirectly-heated mains valve gives this automatically, since in the very nature of things such valves must be "better" than battery valves. But even this superiority is not enough, and only recently has it been possible to load up the loudspeaker with no step-up between detector and output valves. But the output valve in the A.C./D.C. S.T.600 is a triumph of valve design. It combines extreme sensitivity with full mains output. The overall result—and let us also give some credit to the first of this trinity of pentodes, the H.F. amplifier—is one which compares most favourably with the very sensitive battery "600," while giving all that excellence of quality which is obtainable from, and always associated with, "a mains job."

A Universal Design.

Of course, the A.C. S.T.600 is also a most sensitive receiver, but there is certainly something extremely "fascinating" about a set which can be hitched on to any mains that may exist. There are, for example, in London, whole zones which are nourished on juice that never changes its mind, while in neighbouring zones alternating current is standard. Taking an A.C. set over to grandma's sounds very simple, but unless you take thought of her mains you might have the ill luck to set

(*Continued on next page.*)

THE COMPLETED RADIO CHASSIS



This photograph shows the radio portion of the set, which slides into the bottom of the cabinet. The spindles of the controls in the foreground project through the front of the cabinet.

THE A.C./D.C. S.T.600

(Continued from previous page.)

fire to the receiver and even to grandma. But with the present set you can lend it with safety to all and sundry without undue concern regarding the nature of the mains; you have only to adjust the tapping on the voltage-dropping wire resistor.

Outstanding Features.

But the main—I nearly said mains—advantage is that all those now on D.C. will be ready and prepared for the great day when new wine will be poured into old bottles. The foolish virgins will rue the day they bought or built a D.C. set. Fortunately, they will never be able to blame me for having led them up the D.C. garden. The present receiver, by the way, might more logically be called a D.C./A.C. set, since it is primarily a D.C. instrument usable on A.C.

On the H.F. side, the set presents features which are unobtainable on a commercial receiver of the straight type. There is the extremely effective Extractor which has been proved up to the hilt as the most practical—indeed, the only effective—system of stopping swamping on a simple straight set.

The double reaction refinement also puts the receiver in a niche of its own, since the resultant selectivity is far and away greater than that obtainable with the now popular cheap A.C./D.C. factory-built set which is of the simplest circuit design with only two plain tuned circuits—an arrangement which will not only not keep out the locals, but will fail to separate effectively adjacent stations of co-equal strength.

As regards operating the A.C./D.C. S.T.600, I would refer you to the articles on the battery S.T.600. The operation is identical. The Extractor is automatically switched on to the long waves by the action of the wavechange switch which is part of the coil assembly. It is thus possible to cut out Droitwich by tuning the Extractor condenser until Droitwich disappears or becomes extremely faint.

Do not forget, however, that when you go back to the medium waves the Extractor condenser must be tuned so that you cut out the medium wave "local" (which may be National or Regional, according to which is giving trouble on the part of the dial being used). The Extractor will always be pretty sure to cut out or greatly weaken *some* station which *may* accidentally be the one you are looking for! So do not leave the Extractor condenser setting just anywhere. Set it to cut out a local or, if you do not need to do so, set the Extractor condenser **full in**, in which case you are not likely to weaken anything.

A Selectivity Hint.

As regards improving selectivity, do not hesitate to reduce volume on the volume control and then bring up signals on the anode reaction. If aerial reaction is also used, make sure that signals are weak to begin with. They should be deliberately impoverished by reducing the aerial coupler. Remember that if you reduce the volume control you will diminish aerial reaction, and you may easily cut it down so

(Continued on page 366.)

THE PARTS REQUIRED TO BUILD "S.-T.'s" LATEST TRIUMPH

Component.	Make used by designer.	Suitable alternative makes.
1 2-coil unit (S.T.600)	Colvern	—
1 Two-gang ·0005-mfd. V.C., with front trimmer	Polar "Unknob," Horizontal scale	J.B., Ormond
1 S.T.600 Ferrocart "Extractor" coil	Colvern	—
1 ·0005-mfd. "Extractor" variable condenser	Ormond (S.T.600 type with knob)	J.B., Polar
1 Aerial coupler, ·0005-mfd. solid dielectric	Graham Farish, L.M.L.	B.T.S., Polar, J.B., Ormond
1 Aerial reaction condenser, ·0005-mfd. solid dielectric	B.T.S.	Polar, J.B., Graham Farish
1 Anode reaction condenser, ·0003-mfd. diff. solid dielectric	Graham Farish	B.T.S., Polar, J.B., Ormond
1 Volume control, 50,000-ohm, graded for variable-mu	Colvern S.T.5C	—
1 Tone control, 25,000-ohm, graded for variable-mu	Colvern S.T.5C	Erie
FIXED CONDENSERS (Mica dielectric)		
1 ·00005-mfd.	Lissen LN 5250	Dubilier, T.C.C., Graham Farish, Ferranti, Bulgin, Goltone
2 ·0003-mfd.	Lissen LN 11	T.C.C., Graham Farish, Dubilier, Ferranti, Bulgin, Goltone
1 ·005-mfd.	Dubilier 670	T.C.C., Ferranti, Graham Farish, Goltone, Bulgin, Lissen
FIXED CONDENSERS (Paper dielectric)		
1 ·006-mfd., tubular	T.M.C.-Hydra 600-V. D.C. wkg.	Polar N.S.F., T.C.C., Dubilier, Graham Farish, Lissen, Ferranti, Bulgin, Goltone
1 ·05-mfd., tubular	T.M.C.-Hydra 400-V. D.C. wkg.	Polar N.S.F., Ferranti, Bulgin, Goltone, Dubilier, T.C.C., Graham Farish, Lissen
3 0·1-mfd., tubular	T.C.C., type 250, 350-V. D.C. working	T.M.C.-Hydra, Polar N.S.F., Dubilier, Graham Farish, Lissen, Ferranti, Bulgin, Goltone
1 0·5-mfd.	Dubilier 9200	T.C.C., Graham Farish, Lissen, Ferranti, Bulgin, Goltone, T.M.C.-Hydra
1 1-mfd.	Dubilier 9200	Graham Farish, Lissen, Ferranti, Bulgin, Goltone, T.M.C.-Hydra, T.C.C.
1 1-mfd.	Graham Farish	Lissen, Ferranti, Bulgin, Goltone, T.M.C.-Hydra, T.C.C., Dubilier
1 1-mfd.	T.M.C.-Hydra, type 30, with terminals 300-V. D.C. working	Ferranti, Bulgin, Goltone, T.C.C., Dubilier, Lissen, Graham Farish
1 2-mfd.	T.M.C.-Hydra, type 30, with terminals 300-V. D.C. working	Ferranti, Bulgin, Goltone, T.C.C., Dubilier, Lissen, Graham Farish
FIXED CONDENSERS (Dry electrolytic)		
3 8-mfd.	T.C.C., type 502, 450-V. D.C. working	Dubilier, Polar N.S.F., Ferranti, Bulgin

Component.	Make used by designer.	Suitable alternative makes.
CONDENSERS (*Cont'd.*)		
1 50-mfd.	Dubilier 3001	Ferranti, T.C.C., Bulgin
FIXED RESISTORS		
1 100-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin, Graham Farish
1 165-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin
1 1,000-ohm 1-watt	Erie	Polar N.S.F., Ferranti, Bulgin, Graham Farish, Dubilier
1 10,000-ohm ·5-watt	Ferranti G.H. ·5	Dubilier, Erie, Bulgin, Polar N.S.F., Graham Farish
2 10,000-ohm 1-watt	Erie	Ferranti, Bulgin, Graham Farish, Dubilier, Polar N.S.F.
1 20,000-ohm 1-watt	Erie	Bulgin, Graham Farish, Dubilier, Polar N.S.F., Ferranti
1 50,000-ohm 1-watt	Erie	Dubilier, Polar N.S.F., Ferranti, Bulgin
1 300,000-ohm 1-watt	Erie	Dubilier, Ferranti, Polar N.S.F., Bulgin
1 500,000-ohm 1-watt	Erie	Ferranti, Polar N.S.F., Bulgin, Dubilier, Graham Farish
1 1-megohm 1-watt	Erie	Polar N.S.F., Ferranti, Bulgin, Graham Farish, Dubilier
1 Mains resistance	Bulgin M.R.36	—
1 Mains H.F. choke	Wearite H.F.11	—
1 Aerial reaction choke	Lissen LN5092	B.T.S., Graham Farish "Snap"
1 Anode reaction choke (screened)	Graham Farish H.M.S.	Wearite, Bulgin, Varley
1 L.F. choke	Varley D.P.10	R.I., Ferranti, Wearite
1 L.F. choke	Ferranti B.8	Varley, R.I., Wearite
3 7-pin valve holders	Benjamin	Bulgin
1 5-pin valve holder	W.B.	Bulgin
1 Double-pole on-off toggle switch	Bulgin S.88	—
1 Safety fuse holder and mains connector	Bulgin F.18	—
1 Standard 5-amp. 2-pin socket	Bulgin P.29	Goltone
1 Permanent-magnet moving-coil loudspeaker	Rola. Special type for A.C./D.C. S.T.600	—
1 Cabinet, with shelf and baffle	Peto-Scott	—
1 Terminal strip, 16" × 3" × ⅛" ebonite	Peto-Scott	—
3 Bakelike mounting strips, 2" × 1½" × ⅛"	Peto-Scott	—
1 Bracket for mounting toggle switch	Peto-Scott	—
1 Bracket for mounting 8-mfd. electrolytics with terminal	Peto-Scott	—
1 Baseboard, 16" × 10" × ⅛" "Metaplex" as for S.T.600	Peto-Scott	—
2 Terminals	Belling-Lee, type R	Clix
2 Anode clips	Belling-Lee, No. 1167	—
Connecting wire, mains flex, screws, etc.	—	—

Are Our STUDIOS BIG ENOUGH?

asks ALAN HUNTER

WHEN Broadcasting House finally raised its curiously ship-like head in Portland Place, London, a great deal of fuss was made of the twenty-two studios contained within its central "tower."

Among these was included, for the first time in British broadcasting, what was justifiably called the Concert Studio. Everyone who visited Broadcasting House at its opening was duly impressed. More especially with the obvious implication that the more or less newly-formed B.B.C. Symphony Orchestra of 114 players would at last find a worthy home, instead of being "farmed out" at Big Tree Wharf studio down by Waterloo Bridge.

A Glaring Inadequacy.

Imagine the genuine surprise of those whose job it was to describe the wonders of Broadcasting House to a nation-wide press when they were told that the concert studio, expressly built for large orchestral concerts, was not large enough for the full B.B.C. Symphony Orchestra!

Far from being able to accommodate the hundred-odd players of this imposing combination, the concert studio had been designed for a maximum number of 80 or so players.

At that time this glaring inadequacy, though sufficiently serious, seemed to be the only real object of criticism. Amidst so many wonders it was not surprising that the scribes, momentarily disconcerted, made little of an outstanding anomaly.

Expansion.

Time has shown, of course, that the whole conception of the design of Broadcasting House was on too limited a basis to admit of even a moderate amount of expansion. So that to-day we find a bridge connecting the main house with a host of temporary dwellings adjoining the site. One passes somewhat surreptitiously from the "Big House" to the little houses by ascending to the third floor in the lift and gingerly stepping across the seemingly frail bridge near by. In other words, the inadequacy of the concert studio is submerged in a realisation of the inadequacy of the whole building.

It looks almost as though the B.B.C. has despaired of trying to encompass its many ramifications under one roof—if one judges by the various external studios and halls now being used for the daily round of broadcasting.

That this is not wholly true is suggested by the fact that the B.B.C. now makes no secret of its intention to pull down the adjoining Regency houses and to double the size of Broadcasting House.

> The rapid expansion of broadcasting and the inadequacy of the accommodation at Broadcasting House has made it necessary for the B.B.C. to construct new studios elsewhere. Recently the giant studio at Maida Vale was opened, but even this, suggests our contributor, is not completely adequate for the needs of the full B.B.C. orchestra of 119 players and the chorus.

That even this drastic and considerably expensive expansion of studio and office accommodation will not completely solve the problem is evident from the work going on at Maida Vale, where a big concert hall studio is now in operation, and where four smaller studios are in course of erection.

I am reminded of the recent opening of the Maida Vale studio, which I attended with due reverence a few months ago, by some remarks made in the B.B.C.'s amazingly dull Annual for 1935. Maida Vale is quoted by the research department as being a good example of the type of studio construction that has been found acoustically satisfactory for broadcasting.

"This is the largest broadcasting studio yet constructed in this country," runs the report, "having a volume of 230,000 cubic feet, an average reverberation period of a little over 2 seconds, and a capacity for about 100 performers."

What specially intrigued me was the reference to only 100 performers. For, as you know quite well, the full B.B.C. orchestra, for which this Maida Vale studio was admittedly designed, now consists of 119 performers. In other words, is the studio nominally 20 per cent overloaded when the full orchestra is performing? That was my natural question.

For Rehearsal Only?

The engineering department rather airily waved aside my question as "splitting hairs." Yet with my well-known urbanity I persisted. If the figure of 100 performers means anything at all, it must mean that anything much above that figure will be less satisfactory. And 20 per cent is quite a lot. If the figure of 100 performers is purely arbitrary—for which 120 performers can just as easily be read—why then I suggest the reference is misleading, if not actually slipshod.

The real reason for constructing Maida Vale was to provide the full orchestra with a permanent home when Big Tree Wharf was given up to the tender mercies of the Waterloo Bridge demolition gang. Yet we find this specially designed studio quoted as being suitable for a capacity of about 100 players. Quite apart from the fact that this is 16 per cent less than nominal needs, we have to take into account the chorus of 250 voices. It seems that the only time the Maida Vale studio is used for the whole array of orchestra and chorus is at rehearsal time.

Queen's Hall.

The actual broadcasts of such elaborate performances, it is explained, are given from Queen's Hall, where a full audience can be accommodated. From which emerges the not uninteresting political fact that the

(*Continued on page* 366.)

IT WILL ACCOMMODATE 100 PERFORMERS

The largest studio in use by the B.B.C.—the concert hall studio at Maida Vale. It has a capacity for about 100 performers.

BARRY KENT CALLING

News and Views from the "Big House."

I HEAR the B.B.C. Board of Governors have decided that the experience of two years' working with one Controller of Programmes is not satisfactory. The breakdown of Colonel Dawnay's health is regarded as evidence that the work is too exacting for one man. Therefore the handling of programmes, after Colonel Dawnay goes in the autumn, will be put in "commission," that is, it will be split up into three or four main sections. The entertainment departments will form one group, the "spoken word" another.

* * *

Opera Troubles.

Opera relays from Covent Garden are causing the B.B.C. grave concern. The trouble is that the prompting comes through so clearly as to mutilate the transmission. Strenuous endeavours are being made to repair the matter, but without much hope of success. This is a strong new argument for the case of those who are working for the restoration of studio opera.

* * *

Original Conductors.

I was told a curious thing round at Broadcasting House the other evening. It was that experience had proved that it was not wise as a rule to invite the original conductors of musical shows to conduct broadcast productions of these shows. It is next to impossible to get the original conductor to adapt himself to the changes necessary for such condensed performances.

* * *

"From the London Shows."

The B.B.C. is about to invite Mr. Harry Perritt to bring his orchestra and some members of the company from the Alhambra Theatre to provide studio renderings of the music of shows running in London. This will be "in parallel with" the "From the Shows" programmes of the B.B.C. Drama Department.

* * *

Less Letters for B.B.C.

There are curious variations in the size of the B.B.C. post-bag. For instance, during the week beginning April 29th, 1934, there were 915 letters received in London, whereas for the week beginning April 28th, 1935, the number was only 429. The proportion of adverse criticism increased, the difference being as between 7 and 11 per cent.

On the other hand, licence revenue goes on expanding, so the B.B.C. can justifiably turn to the growing numbers of licensees as better proof of the acceptability of the service. My own view is that correspondence will tend to drop off as the public gets to take broadcasting more as a normal part of the machinery of life. Anyway, the average person does not bother to write.

* * *

A "Gala" Talks Month.

The B.B.C. is planning a "gala" talks month. It will take the form of a short story to be read every night. This is a good idea, but I hope the selection of stories is in the right vein of cheerfulness.

* * *

Armistice Day Programme.

The B.B.C. has decided on an important departure from the traditional Armistice Day programme. There will be a feature programme this year built round the story of Captain Scott in the Antarctic. The idea is to emphasise the heroism of non-military occasions.

* * *

Gerald Cock's Popularity.

In addition to being Outside Broadcast director, then head of the Television Department of the B.B.C., Mr. Gerald Cock is well on the way to becoming one of the principal radio stars. For his commentary on the Procession to St. Paul's on Monday, May 6th, Mr. Cock had 109 plaudits and only one adverse criticism.

* * *

Film Talks for Schools.

The Central Council for School Broadcasting is recommending the B.B.C. to include film talks in school broadcasts. The idea is to develop in the young mind a useful sense of discrimination as well as judgment of the merits of films. The film industry is taking alarm because it sees in this another move to apply an arbitrary idealism to their business.

"LISTEN, FOLKS"

EDDIE POLA, stage and radio variety star, doing some of his quick-fire American style announcing into the "mike."

The Staff Pay Fracas.

I have been talking to several people who were present at the big staff meeting of the B.B.C. when the "incident" about low pay took place. Apparently it has been much exaggerated. The complaint was made on behalf of a small group of manual workers in the Engineering Department. In the ordinary way of business, women would be employed for this work, but in order specially to provide employment for men, the B.B.C. changed the procedure. The scale of pay, although small, is according to Trade Union rates.

* * *

The Canterbury Festival.

On June 18th and 19th listeners will once again hear part of the famous Canterbury Festival of Music and Drama, relayed from the Cathedral. Dr. Boult will conduct. On June 18th there will be a Serenade, given in the cloisters, with 40 members of the Orchestra, while the following evening the Choral and Orchestral Concert will be relayed in full. The acoustics in the Cathedral are exceptionally fine and the effect produced is magnificent.

ON THE AIR

Candid comments on recent programmes by our broadcasting critic.

MUSIC HALL staged a programme this week that went the full ninety minutes without a second's dullness. There were funny folk galore, real drama, real musical comedy, and comedy *à la* Dance Band. The bill was interesting also for other reasons. The Houston Sisters, appearing probably for the last time together, staged a first-class row before "we definitely split." Delicious rowing it was too.

* * *

Then there was Bunny Doyle, a Yorkshire comedian and quite new to broadcasting. Will probably be known as The Yorkshire Comedian before long. Knows all the tricks of the trade. Unfortunately, his matter wasn't as good as his manner. A new comedian isn't expected to dish up old yarns. His major yarn was the old story of the lion and the tiger which has been many times now on the air. Fresh blood ought to have a little that is novel in the turn. The song about the gladiator was quite worthy. It had a good tune.

* * *

George Robey's Turn.

George Robey was at the top of the bill. He sang a clever song about "gairls." Then there was some patter, followed by an old song of his, "In Other Words." This song struck me as old-fashioned now, and (dare I say so?) hardly humorous.

* * *

The best fun of the whole ninety minutes was provided by that pair of comedians, Archie Pitt and Leslie Weston. Topicality was their best feature. Poked fun at Harry Roy, Teddie Brown (marvellous how far the human skin will stretch without bursting), Bobsleigh (the point of the lame excuse seemed to be missed at St. George's), the Press (best thing ever seen in newspapers is fish and chips), the St. Paul's pigeons, the village squire (the highest point of the church), etc., etc. All these were real good laughs. This pair of comedians are worth their weight.

* * *

The Development of Jazz.

The Carlyle Cousins sang the quaintest harmonies, bringing "Alexander's Rag-Time Band," that hoary ancestor of the modern jazz-number, completely up to date. How jazz has progressed, or retrogressed, during the last two decades! Another of their numbers, "When I Grow Too Old to Dream," was only just recognisable. It was harmonised almost to death. This was not an improvement of the original.

An excerpt from that well-known play, "Mr. Wu," featuring Matheson Lang, was the unusual item of the programme. Contrasting strongly with what had preceded it, it was listened to with deathly

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(*Continued on page* 366.)

The TELEVISION Camera

Full details of an ingenious instrument, which, when pointed at a scene or picture, is capable of converting it into electric pulses ready for broadcasting by a television transmitting station.

By J. F. STIRLING.

THE ideal mode of television transmission would be to point the lens of a small and compact television instrument at the scene or object which it was desired to transmit, and by this straightforward method to generate currents which could be passed directly on to the radio or landline transmitter for dispatch in the ordinary manner. Such is the simple and much-to-be-desired end of one branch of television experimentation.

A year or so ago the practical attainment of such an end might very well have been considered extremely improbable. For, from the very beginnings of practical television working, inventors have been more or less concerned with various scanning systems, all of them more or less complicated, which serve to break up the image to be televised into dots, strips, or pieces and to transmit these image fragments bit by bit.

An Artificial "Eye."

The human eye is, in reality, a kind of television instrument. It receives a focused image on a sensitive screen—the retina—and from thence it transmits visual messages up to the receiving centre in the brain. If only an artificial eye could be invented, a device which would transmit an image in a similar way, the problem of easy television transmission would be solved.

As a matter of fact, ever since the discovery of the light sensitivity of selenium in the '70's of the last century, long, indeed, before wireless transmission and reception were thought of by most people, inventors and scientific workers have often toyed with this truly fascinating idea of an artificial eye. Insurmountable difficulties, however, have arisen in the working of such a device, so that all attempts at the construction of an instrument of this nature have always remained nothing else than laboratory curiosities.

Recently, however, an ingenious American television worker, Dr. V. K. Zworykin, of the R.C.A. Victor Company, Inc., working along modern television lines, has devised an instrument which approaches in many respects the conception of an artificial eye. Dr. Zworykin's invention does not attain the ideal simplicity outlined above. Nevertheless, it constitutes a decided step in the right direction towards the attainment of this end.

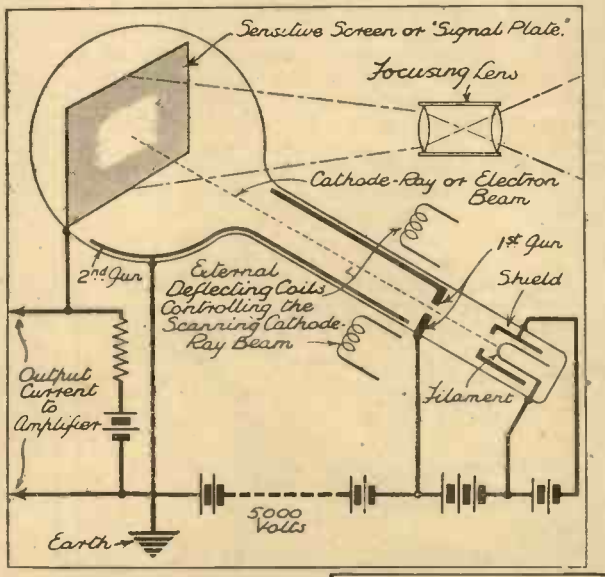
The Light-Sensitive Plate.

Dr. Zworykin calls his instrument an "Iconoscope," the first half of the new word being derived from the Greek *eikon*, an image. Now, the Zworykin Iconoscope works on the principle of the cathode-ray tube, a principle which by this time is well known to all our readers.

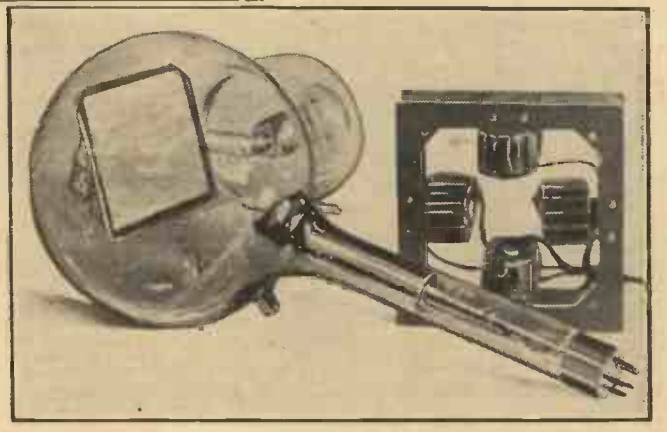
In addition, however, to the cathode-ray tube the Iconoscope contains a sensitive screen of peculiar construction, and mainly in virtue of which the Iconoscope differs radically from all other cathode-ray devices.

The sensitive screen in the Iconoscope comprises a metal plate to which is fixed a thin sheet of mica. Alternatively, the metal sheet may have laid upon it a layer of insulating varnish. On the surface of the mica sheet or varnish layer is deposited a granular layer of photo-sensitive material.

HOW IT WORKS



The diagram above depicts the manner in which the television camera carries out its job of scanning the subject whose image is to be transmitted. It is interesting to compare this sketch with the photograph on the right when considering the various features of the system. The deflecting coils are shown removed from around the tube.



Each individual particle of this upper photo-sensitive layer consists of a tiny particle of metallic silver coated with the metal cæsium. This active material is intimately mixed with thin insulating varnish, so that when the varnish dries the deposited particles on the mica sheet are all insulated from one another and from the metal plate behind the mica sheet. This constitutes the sensitive surface, or "signal plate," of the Iconoscope.

Let us now see how this sensitive layer functions. The silver-cæsium particles are all photo-sensitive in nature. That is to say, they emit one or more electrons under the influence of light. In position on the mica sheet each silver-cæsium particle constitutes one electrode of a miniature condenser, the other electrode being the area of metal plate directly behind it.

The image of the scene or object to be televised is focused upon the signal plate of the Iconoscope by means of an ordinary camera lens. Electrons are emitted from each silver-cæsium grain, and their number is proportional to the intensity of the light.

Scanning the Image.

Thus, when an image is focused upon the sensitive surface each tiny condenser (consisting of the sensitive particle and the area of metal plate immediately behind it) will be charged up proportionately to the intensity of the light falling upon the sensitive particle. A sensitive screen about five inches square contains about five million silver-cæsium particles.

Consequently, when an image is focused upon such a screen five million separate condensers will be charged up to varying potentials, thus setting up a sort of invisible electrical representation of the image on the screen.

So far so good. The necessary electrical counterpart of the image to be televised has been obtained without any process of scanning.

In order to convert this electrical counterpart of the image into a transmittable condition Dr. Zworykin, in his Iconoscope, causes a very narrow beam of cathode rays to traverse the sensitive plate in both

(Continued on next page.)

THE TELEVISION CAMERA

(*Continued from previous page.*)

directions—that is to say, up and down the plate and also across it. This is readily effected by setting up the sensitive screen in a specially constructed cathode-ray tube and by applying carefully controlled voltages to the deflector coils of the cathode-ray portion of the tube.

High Efficiency is Obtained.

When the cathode-ray beam impinges upon each miniature charged condenser, it discharges the condenser, thus liberating the stored-up current, which escapes along an electrode connected to the metal backing of the sensitive plate. In this manner a fluctuating output current is obtained, the current fluctuations corresponding in intensity to the intensities of the light on each of the five million miniature condensers.

This current is passed on to amplifiers and is then transmitted by normal methods.

At first reading, the description of Dr. Zworykin's Iconoscope may appear to be complicated in the extreme. However, once the main idea of the device has been grasped there is little trouble in understanding the details of the invention.

The Iconoscope is really a television camera. In its more advanced form it is fitted inside a box which carries a focusing lens just as a camera does. The Iconoscope camera is placed on a tripod and pointed at the object to be televised, a suitable lead connecting the instrument to the amplifiers in the rear.

Let us now consider the manifold advantages of the Iconoscope in actual use. In the first place, as we have seen, it does away with all forms of image scanning. True it is that it necessitates the employment of a system of cathode-ray scanning of the object focused upon the sensitive plate, but this mode of scanning, being electrical in nature, is of high efficiency.

Constant Illumination.

The light is impressed upon each of the five million miniature photo-sensitive elements *continually*. In other television systems of transmission the photo-sensitive cell has to deal with rapidly changing light intensities.

Thus, in the Iconoscope each photo-sensitive particle of the sensitive screen is continually building up an electric charge, a fact which means that, for an equal illumination, the Iconoscope is able to produce light currents many thousand times as great as those derived by the more ordinary systems of image scanning.

The Iconoscope, therefore, is able to function more readily on scenes and objects normally illuminated than any object-scanning television system.

Furthermore, the fineness of the transmitted image is dependent solely (for practical purposes) upon the narrowness of the cathode-ray beam. This, of course, is on account of the fact that the mosaic of silver-cæsium particles constituting the sensitive screen is so extremely fine.

The finest possible results would accrue when the cathode-ray beam was narrowed down to such an extent that it just covered one sensitive particle. Such an attainment, however, even if it were possible in actual practice, would be unappreciated by the eye, which, without a microscope, can hardly discern the granularity of the sensitive screen.

The Iconoscope is the nearest approach to the construction of an artificial eye which has as yet been accomplished.

For the reception of the transmitted images Dr. Zworykin, in his newly-devised system of television, employs an instrument which he terms a "Kinescope." Here, again, the Zworykin Kinescope consists of a cathode-ray tube having within it an extremely high vacuum.

The Receiving Tube.

It contains two "guns," as the specially constructed anodes of cathode-ray tubes are termed. The cathode-ray beam—that is to say, the stream of electrons emitted from the heated filament of the cathode-ray tube—passes through the first gun and is accelerated in velocity by so doing. The second gun is charged to a positive potential of several thousand volts. This speeds up the electron stream further, and by a careful design of the various deflecting plates a very sharp spot image is obtained on the fluorescent screen at the end of the tube.

Essentially, the Zworykin Kinescope differs from an ordinary television-receiving cathode-ray tube only in points of detail.

THE ZWORYKIN KINESCOPE

The receiving cathode-ray tube used in Dr. Zworykin's system of television is called the Kinescope. It is seen above, and has a screen about eight inches across.

The whole novelty of the Zworykin system of television lies in the inventor's truly ingenious conception of the principle of the Iconoscope, a principle which at the present time bids fair to extend itself and to prove a very decided step in the direction of simplified television.

NEXT WEEK

PREPARING FOR TELEVISION

A review of the new television components for home-constructors

AMBROSE and his band are in the news this month, for on June 30th they are giving a huge concert in the Royal Opera House in Covent Garden. This concert is one of the most ambitious efforts that have ever been staged, and has been organised as an attempt to show the British public that it is not necessary for a band to come from the States, to have a foreign name or to be Continental in order to be in the front rank.

Why such an effort is required I cannot imagine, for I think that Ambrose's Dance Orchestra is considered by most to be in the very front rank of dance bands, if not the leader of that rank. No, I do not include Jack Hylton in the competition, for his is a stage band and not an orchestra for dance purposes.

Certain it is that not only are Ambrose's broadcasts and records eagerly awaited in this country but also in America, and so enthusiastic has that country become that special weekly half-hour programmes of Ambrose records are being broadcast by the Los Angeles Radio Station. If America feels like that about it, surely we need have no doubts about the status of the famous Embassy Club band.

Programme for the Concert.

Probably the orchestra will be augmented at the Opera House, as it is for broadcasting purposes, but nevertheless it will be more than "founded" on the famous combination. The concert will be divided into three parts: 1, Commercial Dance Music; 2, "Hot" or "Swing" Music; and 3, Symphonic Concert Arrangements. There is no doubt of the success of the concert; tickets are selling like hot cakes, and it will be surprising if by the time this reaches publication date there are more than a very few seats left.

Part of the proceeds are to go to Dance Musician charities, and if Ambrose can still further put the British bands on the map he will have done a great work. In spite of the popularity of such bands as those of Hylton, Roy Fox, Henry Hall, and Jack Payne, all of whom have had great success on the stage, we are prone to consider that because a band hails from the States it *must* be a prior attraction.

In all something like a million pounds have been paid since the war to American dance orchestras in this country. It is time that we gave our own bands more support—they are in no way inferior to the American—and especially should this support be given as America refuses to allow any reciprocating visits of our bands to that country.

True, Ray Noble has been more than welcomed on the other side of the Atlantic, but he has had to go alone and to employ American musicians. There is still talk about a possibility of Jack Hylton going over, but he refuses to go without his band, and at the time of writing that "concession" by the Americans has not been allowed.

* * *

And, talking about Ambrose, let me bring to your notice his latest Decca record, *My Dance* and *Orchids to My Lady* (F5518). Two very tuneful numbers that I can well recommend.

* * *

One of the orchestras that I am watching with interest is that of Maurice Winnick. It is one of the "sweetest" in this country, and reminds me very much of the Guy Lombardo Royal Canadians, that is so well known to America and to listeners to Brunswick records. The "sweet" saxophone employed by Winnick is very reminiscent of the style adopted by Lombardo's sax, though Lombardo goes in for rather a different style of piano break, and his guitar is more pronounced.

The Radio Three.

I would say that Winnick has a slightly larger band than the Canadian, but he has certainly turned out a tuneful, melodious group of players. He is assisted by the Radio Three, of course, three young ladies of unusually wide accomplishments. I must tell you more about them one day; they are certainly a most interesting trio.

Maurice Winnick's latest record is *Glamorous Night* and *Far Away in Shanty Town*, on Decca F5522.

* * *

When Mantovani gave up his salon orchestra on the closing down of the Monseigneur he decided to get together a combination composed of almost all stringed instruments to play dance music in a sweet, melodious style, although he determined not to lose the original rhythm of the numbers. He argued that the public was getting tired of the blare and raucous type of playing so often associated with dance bands, and that the sweeter style would come as a welcome and refreshing change. To what extent he has been successful can be judged by his popularity at the

(*Continued on page* 366.)

ON THE SHORT WAVES

CONCERNING COILS

Details for making a range of efficient short-wave coils are given this week by W. L. S.

NEARLY six months ago I aired a little grievance about the tremendous variety of short-wave coils on the market. Although the once-favourite two-pin variety had disappeared, six or seven different shapes and sizes remained.

In this section, in the issue of December 29th last, I included a photograph of three of these types, and asked readers to let me know which they preferred. Every single letter I received cast a vote for the compact four-pin type suitable for plugging into an ordinary valve holder.

The "Standard Windings."

What has happened since then ? Practically every plug-in short-wave coil on the market is of that type ! The moral of this little story is : Let Those Who Are In The Know Look After Your Wants. And they can't do that until you tell them what your wants are.

Well, now that we have settled down to the idea of four-pin coils, let's see what we can do with them. Incidentally, they are often called "valve-base" coils by those who don't know better. I had better explain that the term "valve-base" coil, when originally coined, did not mean a coil that fitted into a valve holder, but a coil that was, literally, wound on the base of a discarded valve.

Several readers must have a stock of old burnt-out valves at home ; and many of them must have bases of the plain cylindrical type. In spite of what the pundits, purists and pedants may say, coils wound straight on these bases are *quite* efficient.

I have received so many letters asking for winding details of a set of coils to cover the short-wave bands that I think there must be an awakening on the part of the "make-it-yourself" enthusiast. So let us therefore talk, for a while, about home-made short-wave coils.

The little sketch on this page is fairly important, although it doesn't look imposing. It shows my idea of "standard windings" for short-wave coils of the home-brewed variety. The grid coil is wound with No. 26 enamelled wire, spaced by its own diameter. It's quite easy to make a neat job of this by hand—it isn't as though you have dozens of turns to wind on.

How to Connect.

Two things are important—stretch the wire before you start winding and keep it tight while you're doing the job. Drill your holes for the beginning and end of the winding before you begin operations.

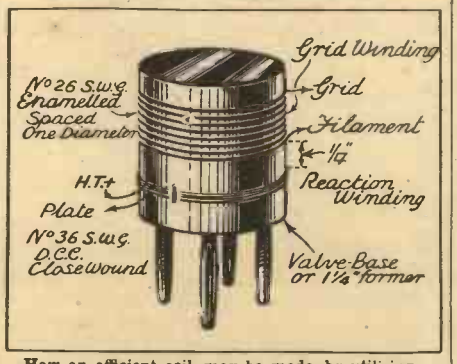
The reaction winding is close-wound with No. 36 D.C.C., and, in every case, is separated from the grid coil by ¼ in. only. It doesn't matter two hoots which pins you decide to connect your four ends on to—every manufacturer of short-wave coils has his own pet scheme, and I don't think any two of them are interchangeable, so you're almost bound to "crib" someone's idea !

What *is* important, though, is the way in which the windings are connected in circuit in the receiver. The two coils should be wound in the same direction, and the outside ends should be the "live" ones. That is to say, the top of the grid coil must go to the grid condenser ; the bottom of the reaction coil must go to the anode ; and the low-potential ends are in the middle.

Look upon it as one continuous coil with both ends live and an earth connection in the centre, and you'll never forget how to connect them up.

Whether you use old valve-bases or buy some 1¼-in. ribbed formers, try to keep to this scheme, and then, when I describe any sort of set, I shall only have to say "'P.W.' Home-made-Coils" to know that you will be all straight.

A "VALVE-BASE" COIL



How an efficient coil may be made by utilising the base of an old discarded valve.

Now what about turn-numbers ? Well, they depend largely upon what sort of person you are ! If you're a normal short-wave enthusiast you will probably want to listen to everything that's going between 100 metres and 10 metres. Possibly, however, you'll be contented if you cover the range of 13 to 90 metres, which can be easily covered in three coils, whereas the full range really wants four.

In either case you'll be using a tuning condenser of ·0001 or ·00015, with or without an additional band-spreading condenser. I suggest that you make three coils. The largest will have 12 turns grid and 7 reaction ; the next 7 turns grid and 5 reaction ; and the smallest 3 turns grid and 3 reaction.

These will cover, very roughly, the wave-bands 40–90 metres, 24–50 metres, and 14–25 metres. I have allowed for a certain amount of damping introduced by a capacity-coupled aerial. In any case, I can only give you rough figures, because I don't know exactly what diameter former you will use, or how much you will decide to space your turns.

For Close Tuning.

Now turn to the table on the next page. This is for the benefit of those who only want to cover certain bands, but to do that very well. It shows the coil sizes for use on the various bands, both broadcast and amateur, with a very small tuning condenser—·000025 mfd.

You may make a complete amateur-band receiver with four of those coils, and each of the four bands will be given a very wide spread on your tuning control. Alternatively, you may wind the five broadcast-band coils (possibly omitting the 16-metre one and making it four) and have really easy tuning on the broadcast bands only.

It means an awful lot of coil-changing to try to cover the whole lot in this way, and I, personally, much prefer to use three coils, a ·0001 condenser and a band-spreader.

Wavechange schemes are being left severely out of the picture for the present, because we're talking about home-made coils. Quite a neat change between two coils can be made with a low-loss two-pole two-way switch, by changing over the grid and plate connections and leaving the low-potential ends of both coils permanently connected.

Methods of Mounting.

Mount them so that their axes are at right angles, and you won't have any trouble with interaction.

Finally, please write to me if you have any ideas on the subject of home-made coils. I found out what you wanted in the commercial line, and now you've got it—perhaps I can help on the home-construction side as well.

There must be many individual preferences in the matter of shapes and sizes, but I think the small diameter coil is preferable on all counts, especially when more than one tuned circuit is to be used. The risk of interaction is so very small, and the valve-holder mounting is so convenient.

Don't forget the possibility of plugging in through a circular hole in the front panel. Refer back to page 42 of the March 23rd issue, where you will find a sketch of this scheme, and see if you can evolve something a little better.

ON THE SHORT WAVES—*Page* 2.

Points from the POST-BAG

THERE are so many letters of interest this week that I can't hope to deal with them all, but we'll try and be brief and breezy. Dipping into the old bag at random, I find a letter from K. B. (Bournemouth), who is nearly crazy with threshold howl. Took out L.F. transformer and put in another—all O.K. for a few hours, and started again.

Third transformer put in—O.K. again, and then started up once more. Now it crackles. Well, K. B., without the slightest hesitation I should say your trouble is dud H.T. But surely you've thought of that and tested it? No, I can't tell you who your O R R—3 A is. Perhaps someone else has heard him.

An Address Wanted.

R. C. (Nelson) wants the address of G 6 F H. Can anyone give him it? He's not in my call book. A. C. (Wallsend) sends in a long-period log on P R F — 5, of which more anon. C. L. (Birkenhead) sends one on Sydney (V K 2 M E), and I have others on W 1 X A Z, W 2 X A F, and my own on W 8 X K. We will try and compare them all and then tell you something about them.

J. S. (Hexham) wants information about low-power short-wave transmitters. I suggest that he obtains the "Guide to Amateur Radio," obtainable from the R.S.G.B., 53, Victoria Street, S.W.1, price 6d.—contents, everything you'll ever want to know about amateur transmission. S. J. G. (W.C.1). please note also.

R. C. S. (Anerley) is a red-hot enthusiast whom I am meeting for the first time. He has kindly sent me some "dope" on L.T. eliminators, which I am forwarding to T. J. S. (Ontario), who asked for it. He also encloses, for my own amusement and yours, a marvellous description of an all-wave receiver, using a hexode and a crystal, complete with fixed reaction, direct-drive tuning (·0005 !), and described as an "all-wave portable." Oh—I nearly forgot—no H.T. is required, the 3 volts L.T. serving for "B" battery also!

Many thanks for your other ideas, R. C. S. I'll see what I can do, especially about the kilocycles.

G. W. G. (Ipswich) compares his H.T. eliminator with my own; his is dead silent, although the transformer only cost him 3s.! He also describes conditions of late in a way that fits in with my own findings, and introduces a new term into our vocabulary—"Woman-made static"! Needless to say, he means vacuum cleaners.

T. J. S. (Ontario) forwards some very interesting details of the new "Acorn-Pentode," which can be used for H.F. amplification down to wavelengths of 1 metre! It has revolutionised the design of 5-metre receivers in the U.S.A., and is even going to upset the television apple-cart, as a signal-frequency stage of amplification makes a world of difference.

New Name for W 1 X A Z.

One or two readers complain about difficulty in making the "B.C.L." Two oscillate with the smallest coil in circuit. I have an idea that they may be using aerials of such shape and size that the inductive coupling provided is too tight. Will they all please try a very small variable condenser in series with the aerial connection to the set? A "neut" or a preset of ·0001 maximum is suitable.

C. P. S. M. (Sutton) sends an interesting letter which wants more space than I have left here. As it's mostly outpourings of tremendous enthusiasm about the short waves, I'll just thank him for it and assure him that it's appreciated.

J. W. D. C. (S.W.1) wants to know whether W 1 X K (31·35 metres) is a new station or merely a new name for W 1 X A Z. The latter is actually the case.

Will J. J. S. (Roxburghshire) and many others who ask for the addresses of American amateurs please note that there are so many of them using high-power telephony that I can't possibly give them separately? Send letters c/o American Radio Relay League, 38, La Salle Road, West Hartford, Conn., U.S.A., but don't necessarily hope for a reply unless you send a Reply Coupon.

Some of these fellows using 500 watts or more receive hundreds of reports every week and can't possibly deal with them all. I once came on 40 metres with 50 watts of phone, and it took me a whole day to answer the reports that I received!

A Fine Total.

"C. T." (Grimsby) seems to have found conditions rather exciting, but variable. I agree with him when he says that W 2 X A D (19·56) has improved enormously and is now the best "DX" signal on the air. Others interested in amateur-band telephony reception may be interested to know that "C. T.'s" total is 109, including stations in Hayti, Dominica, Jamaica, Cuba, Panama and Egypt.

"G. A." (Epsom) asks some questions about the mains input-filter that I described recently. The formers for the two chokes are cardboard, about 8 in. long and 1½ in. in diameter, and are wound with 24 enamelled wire, spaced about half a diameter.

Finally, please don't send me stamped envelopes and ask for a reply by post, because *that* is just as impossible nowadays. I will do my best to answer short queries on this page, but I shall have to take on a staff of ten if I am to answer everything direct!

NARROW-BAND COILS

Wave-band	Grid turns	Reaction turns
160-metre (amateur)	50	25
80-metre (amateur)	27	15
49-metre (B/C)	12	7
40-metre (amateur)	10	6
31-metre (B/C)	8	6
25-metre (B/C)	7	5
20-metre (amateur)	5	3
19-metre (B/C)	4	3
16-metre (B/C)	3	3

All coils wound with No. 26 enamelled (grid) and 36 D.C.C. (reaction) on 1½-in. formers. Reaction winding ¼-in. from grid winding. All tuned with ·000025-mfd. variable condenser.

SHORT-WAVE NEWS

IMPORTANT transmissions in the Empire programme in the near future include relays from the Silver Jubilee Tattoo at Aldershot on June 13th and 14th. All five transmissions are putting this out at various times.

Commencing on July 1st, the new Transmission 6 (for Western Canada and U.S.A.) will become a regular daily service instead of being put out on four days only. The programmes will include a comprehensive news bulletin and rather more performances by "live" artists than have hitherto been transmitted.

Conditions recently have been very good indeed. Readers report excellent reception on all bands, except that 49 metres is now fading off a little with the longer days and the increase in atmospherics.

The Popular 20-Metre Band.

The feature of all readers' letters is the popularity of the 20-metre amateur band, chiefly on account of the large number of high-powered telephony transmissions from the U.S.A. Stations all over the States are heard, even from the difficult fifth district, including Texas, New Mexico, and other remote States.

A new section of the Anglo-American Radio and Television Society, known as the

TEA WITH THE "H.A.C."

This picturesque snap comes from Mr. F. Ward, of Saltash. The receiver is an "H.A.C." short-waver designed by W. L. S.

North Surrey Branch, has just been inaugurated. The man in charge is Mr. Ralph Evans, 182, Ewell Road, Surbiton, Surrey, and some very attractive programmes have already been arranged.

The London Branch (as distinct from the West London Branch, which has been running for two years) is in the hands of Mr. E. Norman, 20, Varley Road, West Ham, E.16. Readers in North Surrey or London are invited to write to either of these gentlemen for fuller particulars.

Recent important 5-metre tests have not been fully summarised at the time of writing, but full details, together with announcements concerning some further tests, will be published next week.

There is plenty doing on 5 metres, and on lower wavelengths, too.

W. L. S.

How to Improve Your Quality

Does the quality from your set completely satisfy you? You can alter the tone to just what you like by means of the simple addition described in this article.

By L. E. T. BRANCH, B.Sc., A.I.C.

IN the early days of wireless it was quite a difficult matter to design a set which reproduced all the audible frequencies even approximately equally. The middle notes of the piano always came through without difficulty, but the low and high notes were very elusive.

To-day there is no reason at all why everyone should not possess a set in which the low notes and the high notes are almost equally amplified—at least, sufficiently so for practical purposes.

No longer should any amplifier be deficient in low or high notes; both transformer coupling and resistance coupling have been brought to a very high level of efficiency, and, with good components and modern standard design, all L.F. amplifiers can be substantially uniform, say from 50 to 5,000 or even 8,000 cycles.

Using Two Speakers.

No single loudspeaker, however, has yet been made which gives a uniform sound response, so that the problem still remains as to the best method of taking the amplified signals from a "straight-line" amplifier and converting them uniformly into audible sound. The so-called dual loudspeaker, consisting usually of two dissimilar moving-coil speakers in parallel, has been one attempt to even up the somewhat uneven response of the single loudspeaker.

Again, the ordinary moving-coil loudspeakers tend to be somewhat deficient above about 4,000 cycles, and to make up for this the "tweeter" has been introduced, this being a specially designed speaker whose efficiency is greatest at the very high frequencies, say 5,000 to 10,000 cycles, and is intended only to be used as an addition to one or two of the usual kind of moving-coil speakers.

Simple Correction.

When using only a single loudspeaker usually a substantial improvement can be effected by a simple but accurate tone-correction circuit of the kind to be described. With a dual loudspeaker the same is true almost as much; and even when a tweeter is employed it may be difficult to match it accurately with the other speaker or speakers, in which case it is often simpler to use a tone-correction circuit earlier in the amplifier.

A tone-correction circuit is most conveniently and efficiently applied in the anode circuit of an L.F. valve. If there are two L.F. stages, then it can be applied to either one of them, although usually the most convenient place is in the anode of the valve which precedes the output valve or valves.

The present article describes a simple form of tone-correction circuit which is of universal application and can be embodied in any set. The circuit itself is shown in Fig. 1, and consists of a resistance R, to one end of which is connected an H.F. choke H, tuned by a fixed condenser C_1, and at the other end of the resistance R there is a condenser C_2.

The ends AB of this circuit should be connected across the anode resistance of the valve in the case of resistance coupling, or across the primary of the transformer in the case of transformer coupling. Figs. 2 (*a*) and 2 (*b*) illustrate the simple way in which the tone corrector is connected in these two cases. It will be noticed that none of the existing connections in the set should be removed. In Fig. 2 (*a*) the resistance R_1 is the customary anode resistance already in the amplifier, while Fig. 2 (*b*) is a normal type transformer coupling.

Three Sections.

The tone-correction circuit here described really divides up the whole range of audio frequencies into three very convenient parts, namely the low, the medium and the high frequencies, each of which can be controlled and adjusted very easily without affecting the others by simple choice of the component values of the circuit, as will be described.

(1) The resistance R is responsible for the amplification of the middle notes, say 200 to 3,000 cycles.

(2) The condenser C_2 determines the amplification of the low notes, say 32 to 200 cycles.

(3) The tuned H.F. choke amplifies only the high notes, say 3,000 to 8,000 cycles.

Considering the amplification of the high notes, we may tune the H.F. choke either to, say, 5,000 cycles or to 7,000 cycles, according to choice. The choke must be a low-resistance air-cored H.F. choke (iron-cored H.F. chokes have too high an effective resistance).

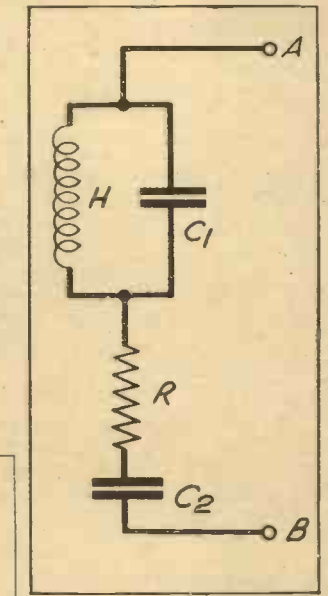
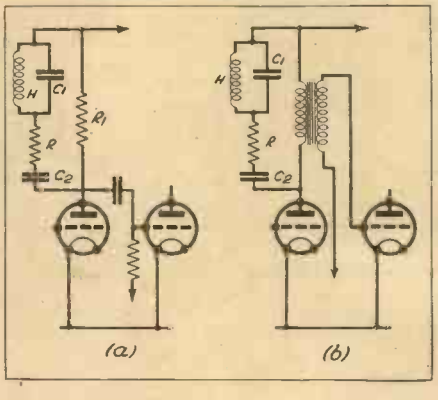
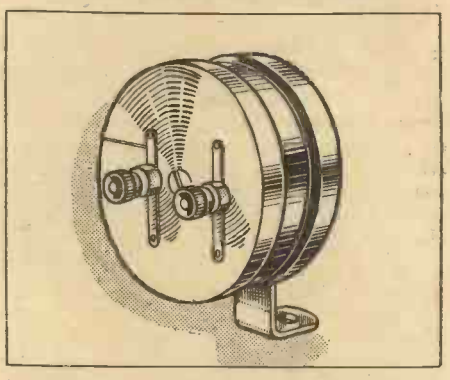


Fig. 1 (above) shows the complete additional circuit: while Fig. 2 illustrates the way in which it is joined to an R.C. or a transformer-coupled amplifier.

WHERE TO WIRE IT



THE TYPE OF CHOKE



This is the sort of choke recommended by the author for the tone-adjusting circuit.

Low-Resistance Choke.

The air-cored chokes used in the measurements here were the special Kinva slab-type chokes made by Postlethwaite Bros., of Kinver, Stourbridge, Worcs., who specialise in these components for tone correction. The resistance of these chokes is low, which is an important advantage, the 1-henry choke having a resistance of only 575 ohms, and the others are in proportion.

If the condenser C_1 is of capacity ·002 mfd. a choke of ·5 henry will be tuned to approximately 5,000 cycles, while if C_1 is made ·001 mfd. it will be tuned to about 7,500 cycles. The latter value is recommended, since it gives good amplification somewhat beyond 7,500 cycles and enables good correction to be obtained for the very highest harmonics.

(*Continued on next page.*)

HOW TO IMPROVE YOUR QUALITY

(Continued from previous page.)

The highest harmonics always need a little boosting, whatever the type of set or even whatever loudspeaker system is employed, because these very high notes lose some of their original intensity in the radio-frequency side of the receiver. It is very rare that one uses such flatly tuned H.F. circuits that the sidebands are not cut at all. In other words, even a straight-line L.F. amplifier, followed by an ideal straight-line loudspeaker system, still needs some correction to make up for loss of sidebands.

The very lowest notes also always need at least a little boosting if the baffleboard is not of *infinite* dimensions. Of course, the larger the baffle the less boost required. On the other hand, it is not a good policy to use an inefficient baffle and then try to make up the deficiency by a low-note boosting circuit. The circuit here described is intended for use after one has obtained a baffle which is as good as possible, including freedom from resonances.

Typical Correction Curves.

In order to simplify as much as possible the reader's work if he wishes to apply these corrections to his own set, there will now be given four typical sets of component values which give four very useful corrections over a sufficiently wide range that one of them is almost certain to be suitable.

The component values required to produce a given correction are dependent to some extent on the impedance of the valve; hence in the table there are given sets of values for valves of impedance 7,500, 10,000, 15,000 and 20,000 ohms. For intermediate values of valve impedance it is quite sufficient to choose from the nearest

HOW TO CHOOSE YOUR VALUES

Correction	C_1 in mfd.	H in henries	R in ohms	C_2 in mfd.	Valve impedance
Curve A ..	·001	·5	20,000	·25	7,500
„ B ..	·001	·5	20,000	·1	
„ C ..	·001	·5	10,000	·25	
„ D ..	·001	·5	8,000	·5	
„ A ..	·001	·5	25,000	·2	10,000
„ B ..	·001	·5	25,000	·1	
„ C ..	·001	·5	15,000	·25	
„ D ..	·001	·5	10,000	·5	
„ A ..	·001	·5	40,000	·15	15,000
„ B ..	·001	·5	40,000	·07	
„ C ..	·001	·5	20,000	·2	
„ D ..	·001	·5	15,000	·35	
„ A ..	·0005	1	50,000	·1	20,000
„ B ..	·0005	1	50,000	·05	
„ C ..	·0005	1	30,000	·1	
„ D ..	·0005	1	20,000	·25	

of these four values. Thus for a valve of 12,000-ohm impedance one chooses the components the same as for a valve of 10,000 ohms.

Now, curve A of Fig. 3 illustrates the correction (measured) to give only a small boost to both the very highest and very lowest notes. This is a good starting-off ground for experiment, especially where a fairly large heavy baffle is employed.

The component values to give this correction are easily read from the table. For example, if the valve has an impedance of about 10,000 ohms the circuit values for the correction curve A will be seen to be those shown in the table. Similarly one reads off the values for obtaining the results shown in curves B, C and D.

It will be noticed that curve B only differs from curve A in that it shows a little

CURVES FOR DIFFERENT CORRECTIONS

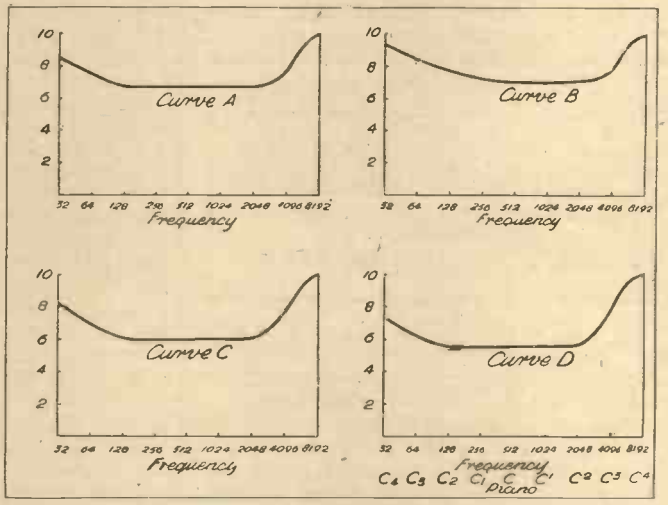


Fig. 3. These four response curves show different degrees of correction obtainable, and should be used in conjunction with the table below.

greater boost to the very low notes and may be useful where a medium or small-sized baffle is fitted to the loudspeaker. On the other hand, if the baffleboard is large and efficient, curve C should be tried after trying curve A. Curve C shows only a small boost to the very low notes, but gives a greater boost to the high harmonics.

Curve D gives a still slightly greater boost to the high harmonics, with a little less boost to the very low notes, and can be tried where the loss of high harmonics is at present very noticeable.

Not Drastic.

One very important point to bear in mind is that none of these corrections is extremely drastic, since the purpose of this article is not to put forward methods for correcting severe losses occurring in the other parts of the receiver. The corrections here described are intended to be applied to the almost perfect set, with the idea of advancing it just that shade nearer to perfection which many set constructors strive for.

Consequently, much patience is required in testing out these methods with any individual set. There are few sets to which one of these four curves will not effect an improvement; but since the correction at most is only small the reader must not expect to hear from his set results which are quite unrecognisably different from those being obtained by him at present.

Try it on a Friend.

The ear is notably a very accommodating device, and one gets used to expecting a certain type of reproduction from a familiar receiver, even when such reproduction is quite different from the original. Consequently, if it is already fairly good reproduction a change in it for the better often sounds wrong, except to a stranger who has not become accustomed to the set, i.e. assuming he has not become accustomed to another one like it.

The only safe opinion upon which to rely is that of a musician who is not in the habit of listening to radio at all. Failing such a person being available, the recommended procedure is as follows: first fit to your set the correction shown by curve A and try this out for at least a week or a fortnight.

Next try curve C for about a fortnight. If you prefer curve A, then it is no use going further and trying curve D; but if you prefer either curve B or C, then try curve D for a week or so and make your final choice.

It will be noticed in the table that sometimes the value for the condenser C_2 is rather an odd one. This should cause no difficulty if you remember that the capacity of two condensers in parallel is their sum, while the capacity of two condensers in series is the reciprocal of the sum of their reciprocals. For example, ·07 mfd. is given by a ·1 mfd. in series with a ·2 mfd. Again, one can obtain ·15 mfd. by using a ·5 mfd. in series with a ·25 mfd.

In conclusion, it should be noted that a simple switch for breaking the tone-correction circuit at either end is sufficient to put it out of operation for comparison purposes.

H.T. BATTERY ECONOMY

A reader's useful suggestions.

The Editor, POPULAR WIRELESS.

Sir,—With reference to letter on page 306 and notes on page 311 of POPULAR WIRELESS for May 25th, the following may interest your readers:

In a 180-v. block, tapped for H.T.–1 at 180 v. and for H.T.–2 at 60 v., the extra drain on the section 0–60 renders it useless whilst there is still useful life in the section 60–180, but more often than not the whole block is scrapped.

It would be more economical either:

(1) To use two blocks in series, one of 60 v. for 0–60 and the other of 120 v. for 60–180; *or*

(2) To use entirely separate batteries for H.T.–1 and H.T.–2, of 180 v. and 60 v. respectively, and of appropriate capacities.

With either scheme any exhausted block can be replaced independently as required, without waste of only partly used cells.

Yours truly,

PRAYAG.

A Survey of Tele-Communication

By DR. J. H. ROBERTS, F. INST. P.

WE are all familiar with the various developments that have taken place during the past few years in radio broadcasting, but we do not perhaps realise that all this is but a part of a vast scheme of tele-communication which covers the surface of the globe and embraces every kind of human activity.

I have before me a paper read at the Institution of Electrical Engineers recently by Col. A. S. Angwin, Chief Engineer of the Post Office. This amazing document contains a comprehensive survey of the work which has been and is being done in a score of different fields. In this short article I can only hope to give you the merest outline of a subject of such extent, but those of you who wish for more detailed information may consult Col. Angwin's original paper, which you will find in the Journal of the I.E.E. for 1935, p. 177.

Broadcasting has made immense strides in the past few years, but few of us realise how large those strides have been, and what great advances have taken place in the science of electrical communication in general. In this article our Scientific Adviser gives you a survey of recent developments.

I will first take broadcasting as the subject of primary interest to readers of "P.W." The general development here during the past two years is illustrated by the increase in the number of licensed listeners. At the beginning of 1932 the number in Europe was 13,678,320, and by the end of March, 1934, this had risen to 19,626,315.

The maximum power of broadcasting stations in Europe as provided for by the Madrid Tele-communications Convention, 1932, is limited to 100 kw. in the medium-wave band (200–500 metres) and to 150 kw. in the long-wave band (1,000–2,000 metres), with the exception of one station at Moscow, which has a power of 500 kw.

The New Long-Waver.

As a result of the Lucerne Conference the B.B.C. retained the long wavelength in use at Daventry, but it was realised even in 1932 that the best possible use was not being made of this valuable channel by the seven-year-old transmitter at Daventry, radiating only 25 kw. In the case of Daventry 5 X X the quality in distant areas was markedly inferior to that given by the modern medium-wave Regional stations, and for this reason it was decided to build a new long-wave station with much greater power.

Accordingly, the erection at Droitwich of a new long-wave transmitter of 150 kw. was proceeded with. This transmitter has now been completed: the signal strength which it provides will, it is anticipated, ultimately make unnecessary the relaying of the same programme by a medium-wave transmitter in the London, West and North Regions.

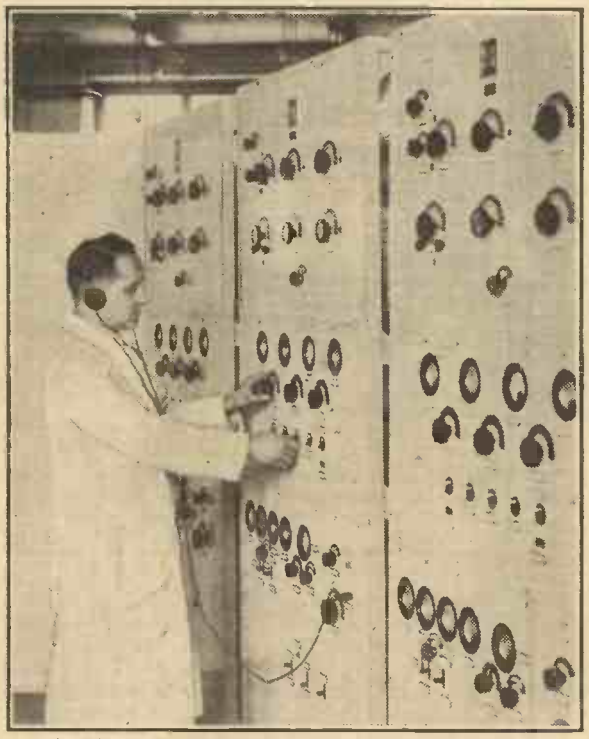
The question of the acoustics of broadcasting studios is naturally a very important one in relation to broadcasting, and has received a great deal of attention. New studio premises have been completed at Newcastle, Manchester, Leeds, Birmingham, Cardiff and Bristol. In London a large studio for the use of the B.B.C. Symphony Orchestra has been constructed at Maida Vale. The new studio has been erected inside a portion of the Maida Vale skating rink.

This construction is interesting in that it is almost a separate building inside the existing fabric of a portion of the skating rink. Separate walls and roof trusses have been provided with a view to preventing the transmission of sound through the members of the roof to any further studios which may be constructed in the remainder of the skating rink at a later date. This broadcasting studio is the largest which has yet been built in this country, having a volume of 228,000 cubic feet.

During the period under review considerable progress has been made in the relaying of broadcast programmes over telephone circuits. In addition to the provision for relaying foreign programmes practically the whole of the internal simultaneous broadcast system has now been changed over from the old overhead open-wire circuits to underground cable circuits. Some 4,000–5,000 miles of underground circuits are permanently rented from the General Post Office by the B.B.C. for linking up the various stations and Regional headquarters.

The second noteworthy development in the relaying of programmes over great distances has been the increase in the use of radio-telephone circuits for linking up the broadcasting organisations in the various continents. An outstanding example of the use of radio-telephone circuits for the collection of material and the distribution of the finished programmes was provided by the Christmas Day programmes in 1932 and 1933, culminating in his Majesty's message to the Empire.

WHERE EAST MEETS WEST



Part of the special short-wave receiving equipment used in conjunction with the recently opened Berlin and Tokio telephone service.

Short-Wave Broadcasts.

On December 19th, 1932, the B.B.C. inaugurated a short-wave broadcasting service from Daventry, intended for reception in the British Empire. Two transmitters were provided, each capable of delivering 15 kw. to a number of directional aerials, and transmissions are made at suitable times on suitable wavelengths in the short-wave bands between 13·9 m. and 50 m. for reception in the various parts of the Empire.

Considerable experience has already been gained on the design of the most suitable aerials for a short-wave broadcasting service of this nature, where the requirements are very different from those for point-to-point services. The original aerials erected at Daventry have now been replaced by others which have proved more suitable in practice, and further developments of the aerial system are still in progress.

(Continued on next page.)

A SURVEY OF TELE-COMMUNICATION

(Continued from previous page.)

A very important matter for investigation is the fading of broadcast transmissions. With the earlier broadcasting stations of comparatively low power the service area was apt to be very limited by reason of the fact that the received signal soon became too much attenuated to override interference. Modern high-power stations, on the other hand, give an adequate signal strength at distances beyond the point where serious fading sets in. The service area is thus determined, not by considerations of signal strength, but by the radius at which fading becomes intolerable.

THE DRONE OF AN AEROPLANE

Various types of aerial have been tried out in the general scheme to improve efficiency of radiation (which depends upon aerial design just as upon actual power at the transmitter). The height of the aerial in relation to the wavelength in use has been found to be important, and the new transmitter at present under construction at Belfast will use an experimental vertical-mast radiator having an adjustable height in the neighbourhood of 0·58 times the wavelength in use.

Changes in Receiver Design.

The superheterodyne type of receiver has superseded the older type of "straight" set, owing to the greater ease with which unwanted signals can be filtered out at an intermediate frequency. The new type of multi-electrode valves which are now available and the improvement in valve performance have tended to simplify receiver design and to reduce the number of stages of amplification.

The better-class sets are now invariably equipped with automatic volume control. Among components, electrolytic condensers and "metallised" resistances are now widely used, and valves of very small dimensions are being produced for use in sets where a minimum of space is of importance, e.g. in motor-car equipments.

The number of ships to install telephony equipment in order to facilitate communication between passengers and land subscribers has steadily increased. A large number of trawlers are now equipped with a simple and robust type of telephony apparatus, which enables them to communicate with the coast stations. These transmitters work on a wavelength of 177 metres with a power of about 50 watts.

From Ship to Shore.

Corresponding equipment has been installed at all coast stations, but in these cases the transmitters are of higher power, with inputs ranging from 500 watts to 3 kw. Although the trawler service is usually operated on a phonogram basis, arrangements have been made at Seaforth to test the possibility of extending the ship subscriber to land subscriber services through the general telephone network.

Amazing developments have been made in the past two years in long-distance telephone facilities, and it is now possible for telephone subscribers to speak to one another from the uttermost ends of the earth. To take a case in point, a subscriber in Sydney can communicate with one in Bulawayo, the circuit being from Sydney to Baldock by radio, Baldock to London and London to Rugby by landline, Rugby to Cape Town by radio and Cape Town to Bulawayo by landline.

Recently a company conference was held between representatives in Bombay, Sydney, Johannesburg and London, each representative addressing the conference in turn, while listening points were provided in Paris, New York, Montreal, Calcutta, Melbourne and Perth (Australia), at which other members of the company were able to hear all the conversations.

Corresponding to the increased requirements for stability and accuracy of frequency for radio-transmission purposes, the measurement of radio frequencies has been brought to a still higher standard of accuracy. The results of international measurements on standard emissions generated at the National Physical Laboratory show that international agreements as regards frequency standards can be attained to a few parts in 100 millions. The improvements in frequency stability on short waves have a direct bearing on new systems of radio transmissions such as the single-sideband suppressed carrier system, where the carrier has to be inserted at the receiving end and the inserted frequency must be within a few cycles per second of that of the original carrier.

A Quartz-Crystal Development.

An interesting development is the production of quartz-crystal plates having a zero temperature-frequency coefficient, which render unnecessary the use of auxiliary ovens and thermostatic control of temperature.

The interference due to electrical machinery, electric signs and so on is a very important matter for radio listeners throughout the world. The problem is, of course, most serious in large towns, being relatively small in open country districts. A Committee of the Institution of Electrical Engineers, representative of all the interests concerned, is now dealing with the question.

It is also the subject of international collaboration through the International Electrotechnical Commission, who are primarily concerned with the correlation of methods of measurement of interference and the consideration of international standards of permissible strength of the interference field.

. . . . .

As I said at the beginning of this article, it is not easy to give you more than a brief survey of the subject. But I think I have said enough to show you how vast a field tele-communication has become and to indicate, in some small way, the skill and enterprise of those whose special duty it is constantly to extend the scope and improve the efficiency of methods of world communication.

"IT'S POURING CATS AND DOGS"

B.B.C. EFFECTS
Nos. 7 and 8.

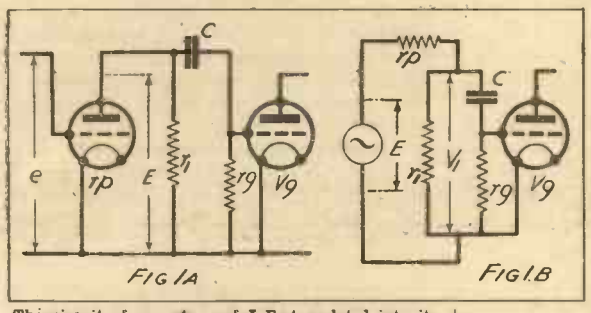
The noise of an aeroplane is made by holding a tenor drum against a disc to which leather thongs are attached. An electric motor drives the disc. In the photo on the right the engineer is busily imitating the sound of heavy rain. This is done by allowing rice to fall from the hand into a basket lined with brown paper. Note how the position of the microphone can be varied at will.

RESISTANCE-COUPLED Amplifiers

Some valuable practical and theoretical details concerning amplifier design are given in this article. By EDWARD LUPTON, D.Sc., Ph.D.

RESISTANCE-CAPACITY coupling has long been recognised to have advantages which are not possessed by transformer-coupled amplifiers. At the same time, do not forget that transformer-coupled amplifiers have advantages not possessed by resistance-coupled amplifiers. A very important advantage of the resistance amplifier is the fact that there are no such things as the resonance peaks, which sometimes occur in transformers having considerable coil capacity.

THE BASIC CIRCUIT



The circuit of one stage of L.F. translated into its electrical equivalents, so that the percentage of amplification can be calculated.

Another advantage is that the resistances function independently of the frequency. In transformers at very low frequencies, say 60 cycles, the impedance is very much lower than the impedance at higher frequencies, say 1,000 cycles. Consequently the bass notes of the organ or other music are not amplified as much as the high notes, and in some cases are lost altogether.

But there are features in resistance coupling which are too often neglected. One of the most important of these is that the presence of the coupling condenser in the circuit makes the resistance-coupled amplifier susceptible to a drop in amplification on the lower frequencies, just the same as in the case of the transformer.

The resistance-coupled amplifier has other disadvantages which must be weighed against its advantages, besides the important one mentioned. One of these is the low amplification per stage which is obtained.

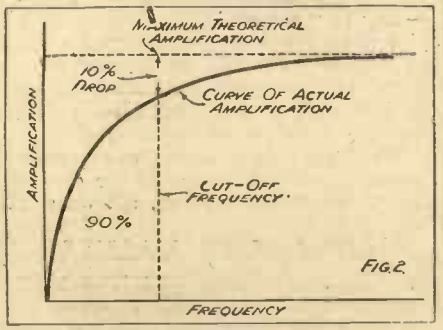
The Actual Magnification.

It is not possible to obtain even the maximum theoretical amplification of the valve. The actual amplification is always lower than this. In Fig. 1A we have shown one stage of a resistance-coupled amplifier.

In this circuit the resistance of the valve is marked rp. Alongside, in Fig. 1B, is shown the equivalent circuit, that is, one which is equivalent in every respect to the circuit of Fig. 1A, excepting that the first valve has been replaced by an alternator which delivers an alternating voltage E, and the latter is in series with rp. The voltage E is the voltage developed at the plate of the first valve when a signal voltage e is impressed on the input of the first valve of Fig. 1A.

If you will compare the two circuits you will find that they are electrically equivalent. Of course, we have omitted the L.T. and H.T. battery connections because we are concerned only with the action of the alternating voltages.

A TYPICAL CURVE



A curve showing approximately what happens in a resistance-coupled L.F. amplifier.

Now we are interested in comparing the value of the grid voltage on the second valve with that of the voltage developed in the plate of the first valve. That is, we want V_1 to be as large as possible compared with E.

We shall see why directly. In the first place, it will be seen that the voltage impressed on the second valve, Vg, is only a part of the voltage across the resistance rg and the condenser C. This voltage is marked V_1 in Fig. 1B. The reason for this is that part of the voltage V_1 is used up in the condenser C, where it does no good. The only voltage that does any good is that which gets to the input of the second valve —that across rg.

Going a step further, we notice that the voltage V_1 is only a part of the total voltage developed at the plate of the first valve (E), for a part of the total voltage is used up in the valve resistance rp. It is evident, therefore, that there is no amplification in the coupling device, but on the contrary there is attenuation; which is a polite way of saying that there is a loss instead of a gain.

We amplify, say, eighteen times in the valve, and then lose, perhaps, 20 per cent of this in the coupling device, bringing our net amplification per stage down to perhaps fourteen or a little more. The amplification we lose in the coupling unit depends on the design, as well as the frequency which we are amplifying, but we may take these figures as fair for the average resistance amplifier at frequencies not too low.

Variations With Frequency.

But, unfortunately, all the elements do not function independently of frequency. The resistances do, but the condensers do not. The voltage V_1 in Fig. 1B is divided between the condenser C and the grid-leak resistance rg.

At low frequencies, when the reactance of the condenser is high, there may be a greater proportion of the voltage V_1 across the condenser, where it does no good, than across the resistance rg, where it is impressed where we want it, that is, on the grid of the second valve.

As the frequency becomes higher the reactance of the condenser decreases; consequently the voltage across it becomes a smaller and smaller part of the voltage V_1, and the part of this voltage across the grid-leak resistance becomes greater and greater.

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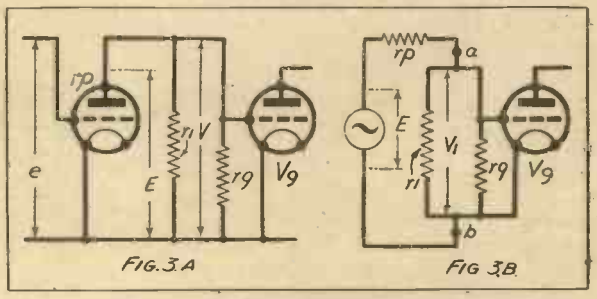
PARALLEL RESISTANCES



It will be realised from this diagram that the anode resistance and the following grid-leak are in parallel, so that the grid-leak should not be of too low a value if good amplification is to be achieved.

AN ENTERTAINING NOVELTY

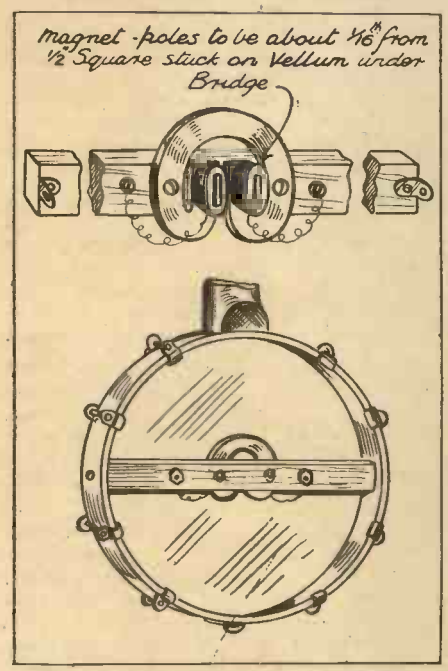
How to make an easily-constructed and amusing "radio" instrument.

By F. M. COOPER, B.Sc.

IF your set has gramophone "pick-up" connections—even if it has not—you can mystify and entertain your friends with this electric "one-string fiddle."

The only essentials are a piece of planed wood about 3 ft. by 2 in. by 1 in., a telephone earpiece, a length of steel wire such as that used on mandolines, along with a few other odds and ends such as every amateur has in his den.

CONVERTED UKULELE



How the ukulele was adapted to allow amplification of its notes and reproduction through a loudspeaker.

A loop is made at one end of the wire and this is screwed down tightly to the board, as shown at A. About 5 in. from the other end of the board a 1½-in. screw, B, is screwed to the depth of ½ in. only, the rest projecting. This is to serve as a bridge of variable height.

Having ascertained at what point the wire will rest in the groove of this screw, a small piece of cocoa "tin," about ½ in. square, is soldered to the underside of the wire at C, about 2½ in. from this point. The other end of the wire, having been cut to the right length, is secured to a large screw eye which serves to tune the wire.

The magnet system of the telephone is screwed to the board and the leads from it are connected by flex to the pick-up connections of the receiver. It may be found an advantage to sink it slightly into the board. The screw B should be adjusted so that when the string is "open" the small metal plate clears the magnet poles by about $\frac{3}{16}$ in

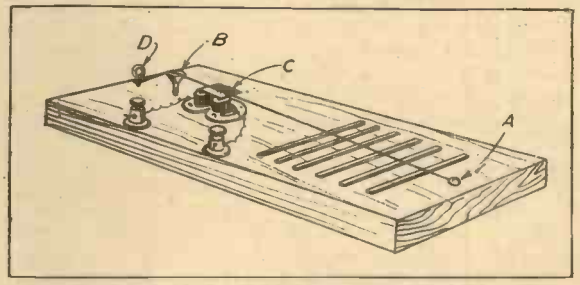
Frets for Semitones.

Having tuned the open string to, say, G on the piano, frets—in my case matches—may be "Seccotined" on to the board to give semitones, their positions being found by experiment. The string needs to be "twanged" only very gently to get quite a big volume from the loudspeaker. Needless to say, the instrument may be played in one room and the notes reproduced in another.

Quite a striking development of the idea I have just completed consists in fixing a rigid wooden platform, about 1¼ in. by ¾ in., carrying a telephone magnet, inside a cheap ukulele banjo. Just under the bridge a ½-in. square of flattened cocoa "tin" was seccotined to the vellum, and the vibrations imparted to it give an amazing yet pleasing result from the amplifier.

The platform is secured by two 4 B.A. bolts to the sides of the instrument (the normal efficiency of which does not seem to be in the least impaired). Meccano angle brackets, in virtue of their elongated holes, are useful for this purpose, as they allow of adjustment of the gap between the magnet and the diaphragm.

VERY EASY TO MAKE



The simplest form of magnetic instrument, described in the article.

To those whose receivers have no pick-up terminals it is only necessary to turn or take out all H.F. valves and detector valve and connect on to the primary of the first L.F. transformer.

Alternatively (possibly best in sets with only one L.F. stage), connect to detector valve grid and to L.T.– or G.B.– 1½ v. If this circuit is used you may prefer to take out the grid leak, since otherwise there will be a slight current through it from the accumulator if the leak goes to L.T.+.

RESISTANCE-COUPLED AMPLIFIERS

(Continued from previous page.)

The next thing to consider is: "How serious is this variation of the amplification, and what must we do to keep it small?" In order to answer this question let us look at Fig. 2. This shows the shape of the curve of actual amplification obtained in a resistance-coupled amplifier.

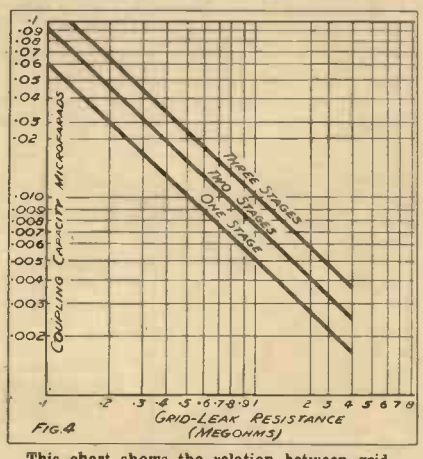
The "Cut-off" Frequency.

At very low frequencies the amplification is low, as we have seen before; it rises rapidly at first as the frequency is increased, and then becomes nearly horizontal, gradually approaching the theoretical maximum at very high frequencies. Now let us assume that there is a certain frequency below which we need not amplify.

We will call this the "cut-off" frequency. It may be, say, 50 or 60 cycles. We rarely encounter musical notes having frequencies lower than this; so it is immaterial whether we amplify them or not, as far as quality of reproduction is concerned. The problem then resolves itself into this question: "How much drop in amplification can we tolerate at the cut-off frequency?"

The human ear is sensitive to changes of sound intensity of about 10 per cent and more. We must, therefore, not allow the amplification to drop more than 10 per cent in the entire amplifier while the frequency is changing from a high value down to the cut-off frequency.

CONDENSER VALUES



This chart shows the relation between grid-leak value and coupling-condenser capacity for one, two or three stages, the capacity given being that which will give not more than a total of 10 per cent drop in amplification at 50 cycles.

Note that I have said that this must be true of the *entire* amplifier. Where there are three stages used in the amplifier the drop in amplification that can be tolerated *in each stage* is only 3·4 per cent.

Limitations Due to H.T.

The maximum theoretical amplification available per stage is equal to the resistance between the points *a* and *b* of Fig. 3B, divided by the sum of this resistance and the valve resistance rp multiplied by the "mu" (amplification factor) of the valve. This gives the overall maximum amplification with this combination of resistances.

We may increase the plate resistance r_1 in order to increase the amplification, but the limitation to this lies in the H.T. battery. When the plate resistance is high we are compelled to use very high-voltage H.T., which becomes unwieldy and costly.

The value of r_1 which has been found to work satisfactorily in practice varies largely with the valve.

We may try to increase the amplification by making the value of the grid-leak resistance high; but when we do this we

(*Continued on page* 365.)

THAT'S HOW IT ALL BEGAN

Those two broadcasting favourites, Clapham and Dwyer, indulge in a spot of reminiscing, in an interview with Leslie Baily.

IN the dim crypt of the Law Courts in London, one day nine years ago, two men were introduced.

One was a barrister's clerk; the other a commercial traveller.

"How d'you do, Mr. Clapham?"

"How d'you do, Mr. Dwyer?"

And that's how it all began!

These two popular comedians have been indulging in a spot of reminiscing with me.

"Yes, I was a barrister's thingummy—er—jig in the — er — doings — er——" chortled Charlie Clapham. "I'd been in the—er—court—er—courting business——"

"You mean that you had been in the legal profession some years and were then a fully fledged barrister's clerk," interrupted the ponderous Billy Dwyer, beginning a lecture on the origin of his partner.

In the Legal Profession.

"Mr. Clapham," he continued, "entered the legal profession when he was fourteen. His first services to the law of England were those singularly useful ones of answering telephones and moistening postage stamps. He went to the War and returned to the legal profession after the Armistice——"

But Clapham pulled him up.

"Hey! You've missed a lot of important—er—serious—er—doings that happened before I answered phones and licked the —er—thingummies."

"Well, what *did* you do before that?" demanded Dwyer.

"Eh? I was born. I mean, that's—er—important, isn't it? Of course, you weren't there. I was—er—it happened—er—they —er—at Birmingham——"

"You were born at Birmingham."

"Yes, and when I was a little boy I used to dream——"

"You used to dream that some day you'd be on the music-hall stage. So did I. I was in the famous war-time party, 'The Bow Bells.'"

"Er—yes. I was in those sort of—er—— But I wasn't like I am now, y'know. Oh, no! Not a bit."

"Well, what were you like?"

"Me? Oh, I was—er—I was just a funny bloke. Yes. Nothing like my present style. Oh, no!"

Clapham's Double Life.

Clapham chuckled reminiscently. I turned to the stolid Dwyer for assistance. He explained:

"Charlie was living at Brighton and appeared in George Graves' original part in 'Veronique' with the local operatic society. But as the years went by he became more and more certain that his place in life was the music-hall——"

"Yes—out of the wife's reach! Ooh—she was kicking up the very—er—dev—er—dickens of a fuss, she was."

"But what about?" I demanded.

"What about? Why, about my—er—my—er—double life. I mean, what with the law, don't-y'know, and the stage at night, I wasn't getting home until the early hours."

It appears that wife and friends had appealed to Mr. Clapham to give up the stage.

"Yes," he said. "But then *he* came along."

"What difference did that make?" I asked.

"Why, we—er—went out and had one—and—er—it began."

"*What* began?"

"Eh? Why, our—er—our doings."

Billy Dwyer roused himself from his armchair, emerged from a cloud of tobacco smoke and boomed forth:

"You mean, we joined forces and got up an act. It was nothing like our present turn. We gave it for the first time at a private party. The Duke and Duchess of York were there. And it was a flop. Then we went to the B.B.C. When we got into the studio we flopped again. We'd never been anywhere like that before——"

"Hi! Yes! I had: dentist's waiting room."

"And so," continued Dwyer, "we just fell to pieces and Clapham was so nervous, he spoke the most utter nonsense, while I delivered a monotonous oration. We knew we should never 'pass.' Then the Variety Director came in and said we were marvellous. Said he'd never heard anything so funny."

"Oo—er—ah! Very funny! *Very* funny!"

And they both roared with laughter at the fortunate fiasco which gave them their first B.B.C. engagement—and gave us Clapham and Dwyer.

"What d'you do with your spare time?" I asked.

Clapham gaped.

"Eh? Spare time?" he asked, as though I had asked his opinion of the fauna of the Mongolian Desert. Again Dwyer came to the rescue.

The "Clapperlings."

"We play golf together. We do everything together, which is a rare thing with double acts. We stay in the same hotels. I visit the Claphams at Cheshunt and Clapham visits us at Finchley."

"Yes. The—er—Claphams—consist of Mr. and Mrs. and—er—five—er—Clapperlings."

"Five offspring. Charlie's eldest is seventeen, a daughter."

"Yes. You haven't any—er—off—er—off—things, have you, Bill? Look! Let's go out and—er—I mean, there's one just opposite—what?"

STARS OF THE AIR

CLAPHAM and DWYER are here seen listening to a Portadyne receiver. Incidentally, these two popular comedians will be heard over the air again in the near future.

A VISIT TO BARI

By CECIL W. LUSTY

ONE of the most interesting stations I visited in my grand tour of Europe's transmitters was the latest Italian station at Bari, on the Adriatic coast. I was shown letters, reporting reception of this 20-kw. transmitter, from places as far distant as New Zealand, China, Japan and Vancouver. Although a small station, Bari is of considerable importance in Italian broadcasting, as it puts out a special Albanian service to Albania, the only European country to have no semblance of radio. Bari also transmits special programmes to Greece, while plans are in hand for programmes in Arabic and Turkish for Africa and the Near East.

The modern studios are in the Via Putignani, in the heart of the city, and are of rather futuristic design. As with the other Italian stations, portraits of Mussolini adorn the walls. The transmitter, with its 240-ft. lattice masts, is located amid flower plots and gardens, somewhat reminiscent of Warsaw. The building itself is of novel architectural design, and might easily be taken for a monastery. An ingenious model of the transmitter, which is in the suburb of Caglie, may be seen in the studios.

Special Link Lines.

Bari is linked by special circuits with Rome, Naples and Palermo, Sicily (there is now a cable under the Straits of Messina), the stations comprising the EIAR's southern circuit, and exchanges and relays programmes with those centres. Bari, of course, has its own station orchestra. As at the other Italian stations, I noticed a Blattnerphone recording machine.

The announcer, Miss Rosa di Napoli, who was previously at the Naples microphone, is one of the best known of Italy's radio speakers. She is also a soprano and an elocutionist, and is thus a most reliable "stop-press" programme artist.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return M.S.S. not accepted for publication. A stamped, addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

RATTLING RESULTS.

From the interest created by recent references in these columns to rattling noises during reception it seems that this trouble is still very common.

It can be caused by a variety of reasons, and, curiously enough, the loudspeaker itself is comparatively rarely at fault. Cases do occur, however, in which some slight maladjustment on the loudspeaker gives rise to a rattle, and several readers have cited instances of this, and of the ease with which it is cured when once the source of the trouble has been located.

We should like to thank the many correspondents who wrote helpfully about this, with the idea of assisting others in the kind of trouble from which they themselves had suffered. From the many reports received in letters to the Editor we select the following as an excellent example of the sort of fault to be guarded against.

It is from Mr. W. Pinchbeck, of Springfield Villas, Brigg, Lincolnshire, and since it is self-explanatory we give it just as written. Mr. Pinchbeck says:

"I read with interest your reply to J. B. B. (Swindon) in your 'Radiotorial' of May 4th issue.

"A couple of weeks back I obtained a moving-coil W.B.4 loudspeaker. I believe this model is about two years old, but on fixing it to a friend's set, I discovered the same trouble as J. B. B.

"I had the speaker out of the cabinet, and watched it working. In this manner I found the cause of the trouble.

"The two leads from the transformer to the coil ran very close to the diaphragm, and on loud passages of music one of these wires would vibrate and rattle on the cone.

"To cure this trouble I pushed a small pad of cotton-wool between the cone and the two wires, and now the speaker is working perfectly."

BACKGROUND "FADING" WITH A.V.C.

C. R. (Exeter).—"There is a peculiar rise and fall of background on my A.V.C. set. The music of distant stations seems to keep fairly constant, but the background rises and fades. Why is this?"

The rising and falling of the background noises is usual in most systems of automatic volume control. If the station's programme is to be held at a steady volume, while the input from it to the aerial is fluctuating due to fading, the automatic control must be compensating for the fading by making the set either more sensitive or less sensitive with each change in the fading.

These increases and decreases in the set's sensitivity will appear to bring up or fade out the background noise, to some extent, which may be noticeable on certain programmes. The effect merely shows that the volume is being automatically controlled with success on badly fading reception.

The latest forms of A.V.C. can minimise the effect, but ordinarily nothing can be done to a set in which the effect was not prevented in the first place.

WHY DOES LOSS OF EMISSION CAUSE DISTORTION?

J. J. B. (N. Woolwich).—"I can understand loss of emission causing loss in volume, but should it make any difference to the quality that cannot be put right by altering voltages, etc.? I have found, if this is done, that valves supposed to be worn out will go on working well for quite a time."

This is quite true. As you remark, provided the volume is reduced and the grid bias re-adjusted to make up for the shortening of the straight portion of the valve curve, there is no reason why the set should not go on working at this reduced volume for a while. Of course, the valve will have to be discarded in the end.

ON THE ADRIATIC COAST

A general view of the transmitter at Bari. This station uses 20 kw., and works on a wavelength of 283·3 metres.

LONG DISTANCES ON CRYSTAL SETS.

P. E. (Havant, Hants.).—"I am much interested in the greatest distance over which it is possible to hear on a crystal set, and I wish you could tell me something in this connection about the difference between receiving from a station which sends Morse and from one which is broadcasting ordinary speech.

"I understand but cannot read the Morse code. And what I cannot make out is why it is often assumed that distances would be greater when listening to a weak Morse station than would be possible if the station in question were speaking, instead of Morsing.

"Surely if the same power is employed in both cases the result is just as recognisable with proper words as it would be spelt out in dots and dashes? *More* so, I should think."

Up to a point your deduction is quite sound, and if the radiated power in both instances were the same it would seem that they should be received equally well.

In practice, however, it is not so much the *strength* of the received signal that matters, but the ease with which it may be recognised above the ever-present background noises, which become of great importance when an attempt is made to receive the very, very weak signals of a very distant station.

Contrary to what you might expect, the (relatively simple) "piping" of a Morse transmission is more easily picked up than the (complex) sounds of speech, and so an expert operator can distinguish the Morse signals when the spoken words are quite indistinguishable.

TRYING A.C. VALVES IN THE "MAGIC THREE."

T. Y. (Bexhill-on-Sea).—"Following your recent article on modernising the 'Magic Three' (page 227, 'P.W.' May 4th, 1935), can you help me with a friend's set, which is one of that famous old 'Magic Three' breed?

"He gets his H.T. from an A.C. eliminator, which has been quite satisfactory. But seeing the description in 'P.W.' he wants to modernise along those lines, but at the same time trying A.C. valves. And naturally, he wants to run these off the A.C. mains by means of a filament transformer, thus doing for the L.T. what he has already done for H.T.

"I showed him that in 'Radiotorial' where you said that changing to A.C. valves on an old design was running the risk of making the set too lively, but as he has got the filament transformer nothing will satisfy him but to try it.

"So I promised to re-wire the filament circuit for the transformer to take the place of the L.T. battery shown in the modernising article on page 228. I thought it would be easy enough, as he has the G.B. battery still and did not want to worry about automatic grid bias.

"But when I look it over it seems a bigger job than I bargained for, as I am not quite sure what to do about the potentiometer across the V2 filament leads, also the ·01-mfd. connection on V1, etc. So can you give me a brief and general idea of what ought to be done with the filament terminals on the new valve holders, and the C (cathode) terminals, if I treat the two wires coming from the filament transformer as L.T. wires?"

An Experiment.

We are glad that you realise that this experimental change-over is likely to make the set too lively, owing to the higher efficiency of the mains valves. But if he is bent on trying it there is nothing like a demonstration to satisfy your friend.

The alterations are not very extensive, and if we suppose that the valve holders are of the 5-pin type, with an extra C terminal to be wired up in each case, we think you can do the necessary wiring from the following brief particulars.

In general you will have followed the wiring of the modernised "Magic" on page 228. But instead of L.T.+ and − leads you will have two leads coming from the secondary of the filament transformer connecting to the respective "filament" terminals of the valve holders.

Across the secondary winding of the filament transformer connect a 30-ohm filament potentiometer, and join the baseboard to the slider of this. The slider will then be the earthing-point, and correct setting of the slider will make for absence of mains hum.

The H.T.— fuse, and switch connections can then remain as at present indicated, but the cathode (C) terminals on the valve holders will have to be joined to the baseboard, too.

In the case of V1, join the C terminal to the baseboard foil, and also to that side of the ·01-mfd. condenser which formerly went to L.T. —.

In the case of V3, join the C terminal direct to the baseboard foil.

Leave the 400-ohm potentiometer out altogether, and join the connection from the grid leak which formerly went to slider direct to the metal of the baseboard.

(Continued on next page.)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

CONNECTIONS FOR "S.T.600" ON D.C.

W. A. (Lowestoft).—"Instead of battery I want to use a D.C. mains unit (eliminator) for H.T. for the '600.' Will the connections be the same, or is there any difference when the mains are used for high tension?"

If a D.C. mains unit is to be used for the H.T. the connections to the set will all be the same as indicated in the diagram on page 234, October 27th issue of "P.W."—*with one important exception.* This exception is the lead to earth, which is *not* to be connected to the earth terminal on the set, but must go, instead, to the earth terminal on the mains unit.

WHAT CAN WE SUGGEST?

B. E. (Peacehaven, Sussex).—"The last set I built was your 'Eckersley National Three,' and the results were not up to expectations by any means.

"The only alterations I made were to the coils; and the valves were not exactly as specified, but I know that these are quite O.K. as they worked previously in the set I had, and I have had them loaned to a friend who reported they were perfect.

"My real reason for wanting a new set, using the old components, is that even with the original parts exactly as specified for that set I never got the results I should. I have tried nearly everything except an H.F. pentode and Q.P.P.

"I am enclosing a full list of my components—can I use them in a modified 'S.T.300'? What do you suggest?"

We suggest, B. E., as politely as possible, that you clear your mind of all your false notions about altering set-designs to fit the components which you have on hand and wish to use.

It is simply *hopeless* to go on as you are going. If you keep using different components or the wrong types of valve, every set you build is a leap in the dark. You will never get a satisfactory set that way, unless you get far better luck than you deserve.

We quite appreciate that you want to use up the gear you have on hand—naturally you do not want to throw money away. But you will never economise by kidding yourself that you are trying this, that, or the other design, when all the time what you are doing is to ring the changes upon a set of old components, one or more of which is probably a dud.

So this is what we suggest. First, choose a design that utilises as many of your components as possible. Secondly, build it *exactly* to specification. Thirdly, if it does not give the results it should, find which component is dud, and put it right.

You are *certain* to get the correct results *if you build the set correctly and use faultless parts.*

VIENNA ON LONG WAVES?

W. J. (Nr. Basingstoke).—"Just below the setting for Kalundborg I came across a fairly strong transmission, on what I reckon to be about 1,250 metres. I recognised the announcer's voice and the language as being familiar, but I did not catch any name in the very short announcement, so I think it might be a relay from a medium-wave station.

"Now I am told Vienna is working experimentally on long waves, with a power of ·5 kw. This would account for the voice sounding familiar, but do you think that such low power could be heard over such a long distance?"

Reported by Other Readers.

We should have thought it very unlikely that you could receive Vienna "fairly strong" if the power were that named; but, as a matter of fact, several readers have reported a similar experience, so it would seem likely that higher power—which it was stated would be used by this station on long waves—is now in force.

So far as we can trace there is no other station transmitting on 1,250 metres, and thus it seems fairly sure that you heard Vienna, since the stations above and below him (Kalundborg on 1,261, and Leningrad on 1,224 metres respectively) are easily recognisable.

RESISTANCES IN COMBINATION.

"STUDIOUS" (London, S.W.9).—"If you have three resistances, A, B and C, all of different values, what is the maximum number of different resistance values you can get by joining them in different ways, or using them separately?"

Unless your nom-de-plume is a misnomer, "Studious," it will be advantageous to work this out, with assigned values, rather than merely give the answer. How would you set about it?

Let us suppose that A has 4 ohms resistance, B 6 ohms, and C 8 ohms. And let us try them separately, then in series, then in parallel, and in series-parallel, numbering the results as we proceed.

Separately, we have:
A .. 4 ohms (1)
B .. 6 „ (2)
C .. 8 „ (3)

In series two at a time, we have:
A + B .. 10 ohms (4)
A + C .. 12 „ (5)
B + C .. 14 „ (6)

In series, three at once:
A + B + C .. 18 ohms (7)

In parallel, two at a time, we have:
A with B .. 2·4 ohms (8)
A with C .. 2·7 „ (approx.) (9)
B with C .. 3·4 „ „ (10)

In parallel, three at once:
A with B with C .. 1·8 ohms (approx.) (11)

We can take the values of "In parallel, two at a time," and join the remaining resistance in series with the combinations (9) and (10).

Thus, combination (8), with C in series, gives 10·4 ohms (12).

Combination (9), with B in series, gives 8·7 ohms (13).

Combination (10), with A in series; gives 7·4 ohms (14).

Finally, we can take the values of "In series, two at a time," and join the remaining resistance in parallel with the combinations numbered (4), (5), (6).

Thus combination (4) with C in parallel, gives 4·4 ohms (approx.) (15).

Combination (5) with B in parallel, gives 4 ohms, the same value as (1).

Combination (6) with A in parallel, gives 3·1 ohms (approx-) (16).

With the three resistances, we can thus obtain 16 different values of resistance.

(Continued on next page.)

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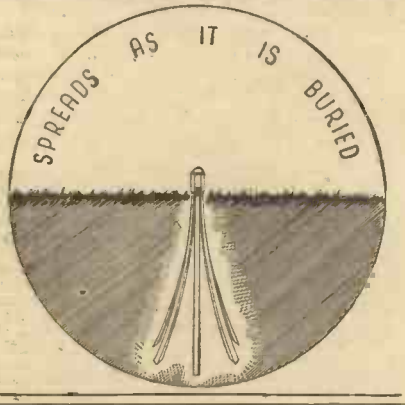

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QUESTIONS & ANSWERS RADIOTORIAL

(Continued from previous page.)

A SIMPLE PICK-UP CORRECTOR.

E. S. W. (Forest Hill, S.E.23).—"Having been troubled with a peaking pick-up which I have tired to correct—so far, in vain—I was especially interested in the details you give of 'a simple-to-build unit' for that purpose, which appears on page 295 of the May 25th number of 'P.W.'

"I should like to try this, and can make it from the details given, but I am unable to decide what would be the correct size for the bobbin on which the inductance is wound.

"Can you say what size of bobbin was used by Mr. Gandon? Also, what wire was used, as although this is not supposed to make much difference in a big inductance, I should like to get my corrector as near to his as possible."

As you infer, the values are not very critical; but as you want to make your coil a close copy of the original, we give below the required particulars.

The bobbin has a core one inch in diameter, with a length of one and a quarter inches for the winding space. The diameter of the end-pieces is one and three-quarter inches.

In the original, the wire used was No. 40, single silk covered.

A HOT-STUFF DESIGN.

E. J. (Walton-on-the-Naze, Essex).—"What I should like is a really hot-stuff design, for A.C. mains operation, on the following lines. Five valves in all, two H.F., detector, and two L.F.'s, the detector being of the grid-leak type, and preferably convertible for power detection.

"The two H.F.'s to be H.F. pentodes, with all ganged band-pass tuning. The L.F.'s to be Q.P.P. output, or ordinary push-pull if that is likely to be superior in power-handling.

"If a large gramophone cabinet is used, could a short-waver be embodied as well, this consisting of only two or three valves, on the lines of the short-wave section of the modernised 'Magic'? Pick-up to be switched in either at the detector or L.F., whichever is advisable. Can you send me a diagram of a set on these lines, if I give you the sketch of the inside of the cabinet, with dimensions and positions of shelves, etc.?"

It would be easy enough for us to suggest a layout, or to indicate what would probably be the best positions for the various components; this would be only the relatively unimportant preliminaries in design. To make a successful set, values would have to be worked out, and various adjustments and alternatives tried.

What difficulties in feed-back, etc., will be encountered in practice it is impossible to say from a study of the theoretical considerations, so a diagram drawn up as you suggest would be useless in itself.

The efficiency of modern components and the magnification of up-to-date valves are so high that extreme care is necessary in arranging the layout and practical details, because certain factors—such as stray capacities, back-couplings, and inductance-capacity values in circuits liable to spurious oscillations—*must* be ascertained in practice rather than calculated theoretically.

We therefore recommend you to select a worked-out design, in which all such difficulties have been "ironed-out," and follow it closely. The day is past when circuit features can be combined haphazardly because they sound attractive.

ONE CONDENSER REFUSES TO TUNE.

B. L. (Amersham, Bucks.).—"At first I thought my trouble with strength was just the summer coming on, but it became more and more frequent. And now the second ·0005 condenser does not tune at all on the medium waves.

"It used to make a world of difference before. I cannot see anything wrong with it, nor with the coil unit. The switch for wave-change is underneath this. Could it be something wrong with that?"

Yes; we suspect the switch from your description. Probably it is not shorting properly when you go over to "medium," and consequently the long-wave section of that circuit is not cut out of action as it should be when you are tuning on medium wavelenghts.

ON THE TEST BENCH

Two of the latest products from the manufacturers reviewed.

A SOUND VALVE HOLDER.

IF we were asked to give an opinion as to what we consider to be the most outstanding improvement in component manufacture during the past ten or so years we should unhesitatingly say the degree of precision obtainable in mass production.

And this because the improvement is marked throughout the whole range of radio parts. We wonder if any present reader of "P.W." could visualise what a nine-pin valve holder, if there had been such a thing, of ten years ago would have been like.

It would probably have cost five shillings, anyway. Actually, of course, there were no valves having more than four pins. Which was just as well. It was most unusual for a valve to fit into a valve holder without its pins first of all being bent about a little. The pins themselves were invariably of the split type, and that was quite essential.

In practically every issue of "P.W." we had to tell readers how to operate on those pins with a penknife! Whether it was the valves whose pins were never in two cases exactly similarly placed, or whether it was the holders at fault, we cannot now remember. Probably the fault appeared in both.

When the five-pin valves were first introduced we expected considerable trouble, but there had been progress in manufacture and it wasn't quite as bad as had been anticipated. Generally, with a bit of wangling and a hard shove the valve could be got into its holder. But getting it out again was certainly a different matter. It was then that both tempers and valves were apt to be lost!

FOR CHASSIS MOUNTING

This Wearite nine-pin valve holder is a real precision job. Soldering tags are fitted throughout.

And now let us leap forward to the present. We have before us as we write a Wearite nine-pin valve holder for chassis mounting. *Nine* pins! It will be obvious to all that with nine pins disposed within an area of round about a square inch there must be one hundred per cent precision of manufacture. Every one of the tens if not hundreds of thousands of valve holders of each batch manufactured must be exactly the same.

Why shouldn't they be? some of our factory-worker readers may well ask, for they know that "repetition production" is not only possible to within high degrees of accuracy, but is a mere routine of the modern factory. Quite so, but it wouldn't have been were it not for the enterprise of the men behind the machines.

But mere precision is not the only thing needed to make a good multi-pin valve holder; there is still the question of the smooth taking of the valve plus undeniably good contact at each individual pin.

There is a novel feature in the Wearite valve holder to ensure this. The brass spring socket pieces are reinforced by steel springs, and we can think of no method of valve-holder construction which is more likely to give a lasting freedom from contact trouble.

Despite the general improvement in radio component construction you still want to choose your valve holders with great care, more especially when seven and nine-pin valves have to be accommodated. The Wearite nine-pin holder is one which we can recommend, though readers should note that it is fitted with soldering tags and has no screw terminals.

A SELF-CORRECTING LOUDSPEAKER.

VOLUME and tone are inextricably bound together and you cannot alter the one without altering the other. Let us take tone first. If you adjust the tone for a given output, then the overall volume must be changed. This will become quite obvious if you give the matter a moment's thought.

The volume, or "loudness" if you prefer that term, is equal to the total "air disturbance" created by all the different frequencies which are being developed. Clearly, then, if some of either the bass or the treble is suppressed or if either is exaggerated, then the volume must be affected accordingly.

But it may not be quite as easy for most readers to see how the tone should be affected by volume alterations. In this case we encounter a characteristic of the human ear. The sensitivity of the ear varies tremendously at different frequencies. It is most sensitive at around and about what are known as the "middle speech frequencies." Its sensitivity falls off rapidly at the bass end of the acoustic spectrum and also it falls off at the treble end.

It is, therefore, quite obvious that as you decrease the volume so will note after note tend to fall away below the level of audibility. Normally, there can, for instance, be practically no bass at all when the volume control of a set is turned down so much that there is only the "intimate loudness" of "quiet room strength."

There is this, too, that a proportionately greater power is needed for the reproduction of bass and very high notes, and to provide this in the ordinary way it is quite essential to "turn up the wick" of the set so that there is considerable loudness.

But we seldom want a set blaring away very loudly, and therefore tone compensation is necessary if a good quality reproduction is to be maintained at the kinds of degrees of volume most of us need for normal listening.

The tone compensation must be bound up with the volume control if a true balance is to be achieved at

SIX WATTS!

This loud-speaker has a tone-compensated volume control built into it and handles up to six watts.

the various settings. You can't test for quality by the ear alone during ordinary reception, because the substance of the reception is varying from moment to moment. It might be possible were the B.B.C. to broadcast series of test frequencies to obtain fairly satisfactory results by purely aural methods, but this they do not do.

But there is a loudspeaker which has a tone-compensated volume control built into it. This is the Marconiphone Multi-Functional Super-Speaker Model 195. The control is mounted in a convenient position on the side of the cabinet and you use it as you would use any quite ordinary volume control. The tone compensation is a purely automatic function.

The "multi-functional" principle of construction embodied in this notable loudspeaker was developed for that excellent 9-valve radiogramophone, the Marconiphone Model No. 292, and it is stated that the speaker is the ideal extension instrument to employ with that receiver or with the Marconiphone models 289 and 296; the other Marconiphone sets can be matched by means of a special adjustment which is provided.

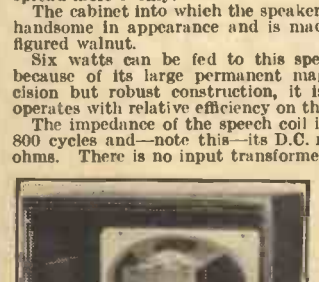
Another special feature of this most interesting loudspeaker is that it employs an elliptically shaped diaphragm instead of one of the usual circular form. The purpose of this is to render the instrument non-directional.

The ordinary cone tends to throw out the high notes in the form of a directional beam so that there must be a falling off of treble for all who do not sit more or less directly in front of it. The Marconiphone elliptical diaphragm causes the high notes to spread more evenly.

The cabinet into which the speaker is built is very handsome in appearance and is made of high-class figured walnut.

Six watts can be fed to this speaker, although, because of its large permanent magnets and precision but robust construction, it is sensitive and operates with relative efficiency on the smallest sets.

The impedance of the speech coil is 9–10 ohms at 800 cycles and—note this—its D.C. resistance is 8·5 ohms. There is no input transformer fitted.



AN OVAL CONE

One of the outstanding features of this new speaker is its non-directional properties. Note the shape of the cone.

The price of the loudspeaker is 8 guineas. That is not a high price in view of the qualities of the instrument. It must not be thought of in the same terms as the standard moving-coil loudspeaker.

We think that the most striking thing noticed during our tests of it was the "non-directional" feature to which we have referred. This is definitely most noticeable. Some speakers are very directional on their high notes, and the effect can be appreciated by even non-critical listeners when it is pointed out to them and they are asked to listen from different angles to, say, a violin item. A high-pitched heterodyne serves as a particularly good test, though, of course, one is always apt to get rather confused by the standing waves which tend to occur.

THE LINK BETWEEN

By G. T. KELSEY.

I HAD hoped as a result of my visit to Manchester to be able this week to give you a pen picture of the vast new Ferranti factory at Moston. But not by a most vivid stretch of the imagination did I do justice in my mind to what was in store for me, and I am afraid that to give anything like an adequate description of this new hive of industry I should require not only this page, but this whole issue of "P.W." all to myself!

I think I can safely say that never in my life have I seen a more striking example of ordered efficiency than that which was apparent as I walked round the serried rows of assembly benches in this giant new factory. And "giant" just about describes it.

Covering in all a floor space of 270,000 square feet, there could surely have been a no more dynamic tribute to the memory of the late Dr. S. Z. de Ferranti than this new home from which, henceforth, all Ferranti wireless products, including valves and receivers, are to emanate.

As may well be imagined, my whole tour was fraught with interesting sidelights on Ferranti production thoroughness, but I think the one thing that appealed to me as being of the greatest significance to "P.W." readers, and the aspect, in my humble opinion, which should most strongly influence the potential buyer, was the elaborateness of the precautions taken to ensure that all Ferranti patrons are assured of trouble-free radio.

Isn't that, after all, the most confidence-promoting aspect of all?

Upon the orderly and systematic way in which this new factory is being conducted, upon the extreme precautions that are being taken to guard against faults, and upon the hundred and one other ways in which the requirements of the potential customers are being looked after, I offer them my hearty congratulations, and I wish them, on behalf of "P.W." readers, the very best of luck in the new venture. Gentlemen, the toast is Ferranti!

* * *

Concerning Car Radios.

From information which has been brought to my notice of late there seems to have been some confusion existing as to the legal position of car radio installations, and not a few people anxious to equip their cars have been holding back pending an authoritative statement as to the present and future positions.

For the benefit of those who may not have seen the official announcement on the matter, it is opportune to mention that the Ministry of Transport has now stated that no ban is to be placed on the use of radio in motor cars, and so henceforth you can drive to music to your heart's content—that is, if you are fortunate enough to have a car.

The effect of this announcement on the sale of car radio installations has, judging by reports, been most startling. An official of E. K. Cole, Ltd., with whom I was recently discussing this matter, told me, for instance, that orders for their car radio equipment had leapt by over 150 per cent since the statement was issued, and they are now employing more people, for the time of year, than at any period in the history of the company.

So long as motorists all choose the same programme in traffic jams, life will be tolerable. But if they don't—well, I think I shall take up poultry farming and go and live in the wilds!

* * *

Battery-set users will be interested to learn of a new range of super batteries which has recently been introduced by Ever Ready.

This battery problem is indeed an acute one, and I am only too pleased to give prominence to any news which means less frequent replacements, especially when it *doesn't* mean a corresponding increase in price.

In the case of these new Ever Ready batteries, they will deliver a higher output of current and will maintain their voltage over a longer period, and yet, in my opinion, they are very moderately priced.

Prices range from 5s. 6d. for the "Super 60-volt" to 10s. 6d. for the "Super 120-volt." and 9-volt and 16½-volt grid-bias batteries are available in the same range at 1s. 3d. and 2s. each respectively.

RESISTANCE-COUPLED AMPLIFIERS

(*Continued from page* 360.)

make it more difficult for the grid charge to leak off the grid.

This is the very reason why we are forced to introduce the grid-leak resistance into the circuit, so we must be very careful about its value. If it is too high the valve "chokes up"; there are likely to be grid "clicks" or even "howling" of the amplifier.

But even without considering the blocking of the grid there is a practical limit to the resistance beyond which it does not pay to go. When using a valve having an impedance of 10,000 ohms and a resistance r_1 of 10,000 ohms little is gained in amplification by making the grid-leak resistance higher than about half a megohm.

Coupling-Condenser Value.

Let us suppose that we are going to adopt these values for our resistance-coupled amplifier. The next question is: "How large should the condenser be so that the amplification will not drop more than 3·4 per cent per stage at a cut-off frequency of 50 cycles?"

It will not be possible to explain in this popular journal how this question is answered. Let it be sufficient to say that when the circuit of Fig. 1B is analysed an equation can be derived from which the chart of Fig. 4 was plotted.

This chart shows the relation between the grid-leak resistance and the capacity required in the resistance-coupled amplifier in order that the amplification may not drop more than 10 per cent in the entire amplifier from the high frequencies to the cut-off.

To show how this chart is applied take the present example, where rp is 10,000 ohms and rg is half a megohm. Also suppose there are three stages to the amplifier.

By following the broken line upward from the point representing a half-megohm for rg to the line marked "three stages," and then over horizontally, we find the capacity required in the condenser C.

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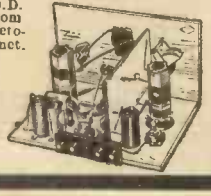

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ARE OUR STUDIOS BIG ENOUGH?

(*Continued from page* 349.)

B.B.C.'s technical development is to some extent at least controlled by a "box office" policy having nothing to do with broadcasting as such.

We have to face the fact that the B.B.C., setting out to design a large orchestral studio, in an existing building that permitted almost any desired cubic capacity, deliberately skimped the size because it intended all the time to carry on its main orchestral broadcasting in public—in, that is to say, a public concert hall.

Not Gone Far Enough.

And why not? That question may well be asked. Am I suggesting, you may query, that the B.B.C. should have built a replica—in size at least—of Queen's Hall? And, if it had done so, admitting an audience as its great size would have allowed, what would be the difference in principle?

Obviously, none at all. Indeed, on the face of things there seems every reason why the B.B.C. should have concentrated on the so-handy Queen's Hall, right opposite Broadcasting House, rather than burrow into the relative wilds of Maida Vale—which no one can admit is central, even if it is fairly accessible from the West End.

But obviously, too, the B.B.C. must needs have its own full-size studio for rehearsals and for the ordinary run of broadcasting of large concerts involving the full orchestra and the chorus. My point is that, in going in for this legitimate expansion, which would never have been necessary had the concert studio at Broadcasting House been adequately designed in the first place, it has not gone far enough.

Even now, with Maida Vale, really big concerts with an orchestra of 119 players and the chorus, if they are to be broadcast with a sizeable audience, must perforce be done from Queen's Hall.

The Crux of the Matter.

And that brings us to the real kernel of the business. On its own admission the B.B.C. says: "Studios of which the reverberation time is sensibly independent of frequency have been considered by the B.B.C. to be desirable, but it has to be remembered that such a condition is *very far from being satisfied in the vast majority of concert halls when containing an audience.*" The italics, for obvious reasons, are mine.

We have, then, to assume that Queen's Hall is the great exception among concert halls. Otherwise the B.B.C. is practically admitting that if it wants to broadcast a concert under full concert hall conditions—assuming the full complement of players and singers—it does so under conditions known to be below the standard possible with a properly designed studio.

Or am I, as a B.B.C. engineer suggests, splitting hairs?

ON THE AIR

(*Continued from page* 350.)

silence. The shrieks of the woman, fearful of Mr. Wu's passions, may have terrified some listeners. The extract was gruesome, or it always threatened to be. However, the small cast was provided with some great opportunities for acting, such as we get only occasionally on the air.

* * *

Ann Croft, the musical comedy singer, represented her branch of the stage with just that amount of success that I think is possible with such actresses, taken as they are from their natural surroundings, and placed in a position of splendid isolation.

* * *

Frank Southall must have delighted the cycling fraternity (if their week-end outing didn't interfere with their listening) with an account of his twenty-four-hour road record ride from Land's End to Cromer. Also he must have delighted his listeners who like talks of any description. In my estimation, this talk must rank with the best of the Sports talks. It was deliberate, quite humorous, and full of those human touches that make an instant appeal.

"Rain coming down like stair-rods" is a new metaphor to me. But in its context it was very apt. The story was vividly told. One could picture Frank throughout in his tights and his "little jacket of black," as he described his riding togs. And what about that Norwich policeman he "took for a ride"? This incident was delightful.

* * *

A late Sunday evening period for a play is an innovation that I warmly welcome. Such a period on such a day seems to me ideal. A bigger percentage of listeners should be in a better mood at this time for this sort of radio fare, which obviously demands greater concentration and indulgence from us than any other. I am not quite certain, however, that "Abraham Lincoln" was the best play to start off with. This is purely a matter of personal taste. I am looking forward to these broadcasts of widely known plays.

* * *

Empire Day was duly celebrated on the air with Canada in the limelight. She told her story, just as these stories are commonly told in broadcasting. They are generally interesting, in spite of the stereotyped manner of the telling. A new form of presentation is, I think, now overdue.

* * *

And there was also the massed choirs and orchestra from the Albert Hall, with quantities of conductors and soloists taking part in the Royal Command performance. There was considerable enthusiasm evident from start to finish of the concert. Radio is kind to music lovers.

C. B.

ROUND THE RECORDS

(*Continued from page* 352.)

fashionable Hollywood Restaurant and the sale of his first Regal Zonophone records which were recently issued. They have been followed by two more discs containing *Street in Old Seville, Lady Sing your Gypsy Song, A Gypsy Loves Music,* and *Bells of Monterey.* The numbers are MR1666 and MR1667.

* * *

Do you remember the attempts carried out a comparatively short time ago on a mountain in Germany to practise Black Magic, when the idea was to turn a goat into a man? A weird and fantastic idea, wasn't it? And yet there is a piece of music that has for its theme just such a subject—the Black Mass.

It is called *A Night on a Bare Mountain,* and was composed originally by Moussorgsky and completed by Rimsky-Korsakov. The symphonic character of the composition leaves very little to the imagination. The isolation of the rugged mountain with the wind beating against the rocks is pictured by the wail of the violins, the woodwind instruments providing a gruesome howling. Gruff voices from the interior of the caves, performed by the brass, intermingle with the external atmospheric sounds.

The chanting of a pagan hymn with responses of raucous character is eerie in the extreme. This is of a crescendo nature, each section of the orchestra adding its quota to the colour of the composition. The scene continues up to the point when a church bell intervenes, when there is an instantaneous transformation, the music declining to a mood of contrasting tranquillity.

The clarinet commences a beautiful solo, an old Russian folksong, which is repeated by the flute, which heralds the approach of dawn. It is an astonishing composition, with a fullness of expression that leaves absolutely no doubt what it is intended to convey throughout the picture.

The recording by Columbia is above criticism, and the Colonne Symphony Orchestra of Paris has given the piece of music a wonderful rendering. It is undoubtedly one of the finest pieces of descriptive music ever written, and certainly ever recorded. Col. LX384.

THE A.C./D.C. S.T.600

(*Continued from page* 348.)

much that you will be unable to bring it back by increasing the aerial reaction with its appropriate knob. When anode reaction only is relied upon, no harm will be done by reducing the volume control setting as long as signals are not made so weak that they cannot be brought back to full loudspeaker strength with the aid of anode reaction.

Aerial Reaction.

Some readers have referred to the fact that aerial reaction is apt to be fierce on the A.C. S.T.600, and that the set oscillates after only a quarter of a turn of the aerial reaction knob. Well, that is nothing to worry about on the A.C. S.T.600 or the A.C./D.C. S.T.600. The matter is wholly under your control. If you want a bigger movement of the aerial reaction knob prior to the oscillating point, you have only to cut down the volume control a little; this reduces the total reaction current available. In any case, aerial reaction is not to be "put on with a trowel." It is not usual to use it if you are intending to work the set's controls in a rough-and-ready fashion.

All these remarks apply equally to all the S.T.600 models, all of which have exactly the same operating controls. An hour or two's familiarity with the controls will breed contempt—of interfering stations.

The A.C./D.C. S.T. 600 Valves

V 1	V 2	V 3	V 4
Mazda VP/1321 met.	Mazda VP/1321 met.	Mazda Pen. 3520	Mazda U 4020

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THE GROWTH OF RADIO

Items of Interest to all readers

By Dr. J. H. T. ROBERTS, F.Inst.P.

WE frequently hear the opinion expressed that the market for radio receiving sets is becoming saturated. In spite of this the B.B.C. figures go up month by month and year by year, and it is gratifying to note that the figures for receiving sets go up in a corresponding way in other parts of the world.

I have before me some information just received from the United States, according to which there are now some 53,000,000 radio receiving sets in use throughout the world. At the end of 1934 there were over 48,000,000. These figures are based on a chart issued every year by the International Broadcasting Office in Geneva, of which our popular fellow-countryman, Arthur Burrows, is the Director. It is estimated that this number of receiving sets represents close upon 200,000,000 listeners and it is still growing rapidly.

The U.S.A. Lead.

More than 40 per cent of the sets of the entire world are in use in the United States, the number in 1934 being over 20,000,000. There are some 23,000,000 in use in Europe. The United States has three times as many sets as any other country, Great Britain taking second place with about 6¾ millions, while Germany has just over 6,000,000.

Several million new sets were added in 1934, two million being installed in motor-cars in the United States. It is estimated that 14,000,000 new listeners were added last year, and the increase was about the same as in the previous year.

Radio is progressing at a great rate in Germany, where some 500,000 new sets were added in about two months of last winter.

As regards the number of sets per thousand of the population, the United States again has the highest figure, with 162 sets per thousand people, Denmark curiously enough coming second with 160 sets per thousand of the population.

British Television Progress.

I said something the other day about the preparations being made by the Radio Corporation of America to spend a very large sum of money in "bringing television out of the laboratory stage and placing it on a commercial basis." This has called forth comment from British companies engaged in this field, and at a recent meeting of the Marconi Wireless Telegraph Company in London the Chairman stated that the television transmitting system which his company had developed would stand comparison with any other in existence. He added that there was at present no reason to believe that any other country in the world had made sufficient progress to introduce an efficient public television service any earlier than Great Britain.

Fifty Pictures Per Second.

Commenting on the declaration of the President of the Radio Corporation of America, to which I have referred above, he said "By way of contrast I may remind you that we are ready to supply transmitters capable of providing a public service of high-definition television of 400 lines and 50 pictures per second.

"With this new art yet in its infancy we must be prepared for further heavy research expenditure, not to take television out of the laboratory into the field of public service—that we have done already—but to improve and develop television just as the broadcasting of sound has progressed from year to year towards perfection."

Quietening the Receiver.

The elimination of noise from radio reception—that is to say the complete elimination—is a matter still for the future. Great strides have, however, been made in quietening the radio receiver and rendering it immune from most of the ordinary types of interference. Those of you who used the very earliest types of all-mains sets, going back, I suppose, some six or seven years ago, will remember some of the difficulties with which we then had to contend. It was considered nothing for a loud insistent hum to override all ordinary reception, and indeed many people said at that time that whilst we would probably be able to reduce the side noises, we would never be able to overcome them entirely.

So far as the A.C. hum is concerned, it can truly be said that in a really efficient and well-designed modern receiver this has been so reduced that it is for all practical purposes non-existent, and a modern all-mains set bears comparison, from the point of view of silent background, with a battery-operated receiver.

"Man-made Static."

The types of interference we are really up against are those produced from electric machinery, electric signs, tramways, electric railways and so on—what are classed generally under the title of "man-made static." These still give us trouble, but valiant efforts are being made by our experts and manufacturers to cope with them, by way of suppressors of various kinds, and there is every reason to suppose that before very long they will be overcome just as mains hum has been overcome.

Radio Cars.

Talking about local interference, it is really very remarkable, when you come to think of it, how good radio reception in motor-cars has become already. Here you have the radio receiver absolutely alongside several high-tension sparking plugs, and at a distance of a few inches from an electrical generator, and notwithstanding all this the interference has been so reduced

(Continued on next page.)

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- ☐ WIRELESS OPERATORS
- ☐ EXAMINATION (state which)

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THE GROWTH OF RADIO

(Continued from previous page.)

that excellent reception is now obtainable. Although many people do not seem to realise it, I personally regard the high standard of radio reception in motor-cars as one of the most remarkable achievements of radio science in recent years.

Non-Inductive Condensers.

You often notice in the specification of the components for building a receiver that "non-inductive" condensers are to be used. Many condensers are made by taking two sheets of tinfoil, separated by a strip of suitably waxed paper, and rolling the whole into a tight roll, this afterwards being pressed or flattened into a suitable form. You can easily see that when the electricity is flowing into the condenser it has to flow around several turns of a conductor, and when the current reverses it has to flow out again, so that there is quite an appreciable amount of inductance. This may not matter very seriously at long wavelengths (low frequencies) but as the frequency rises, the effect becomes more and more important.

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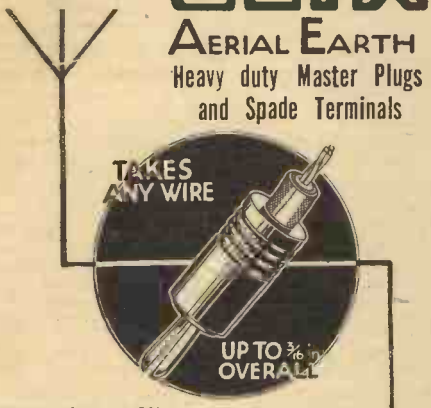

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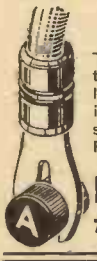

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—*THANKS!*

Preventing the Inductance.

To make the condenser non-inductive, a connection is taken from each turn of the rolled-up foil, instead of just connecting two wires to the ends, and so the current is able to flow straight into all parts of each electrode or "plate" of the condenser simultaneously.

Of course, in a condenser intended for very high frequencies, that is, very short wavelengths, the maker has to take great care in arranging the wires, because, as you know, a wire has inductance of itself. Accordingly, the two wires are wound together so as to form a non-inductive pair, the inductance of the one counteracting that of the other.

By an arrangement of this sort, taking great care in the manufacture, it is possible to reduce the inductance of the condenser to a very small figure indeed. In a really high-class non-inductive condenser the inductance is so small that it is actually less than that of the external wires which connect the condenser to other components of the circuit.

Mica Condensers.

In the foregoing I have been referring to a wound paper condenser, but in the case of a mica condenser, where separate sheets are used all connected together, the arrangement is pretty well the same as that mentioned above, and so the condenser is automatically non-inductive.

If you are buying a fixed condenser, of the paper or tubular type, and it is to be used in a circuit where a non-inductive condenser is specified, you should make quite certain, before buying it for the purpose, that it is actually non-inductive.

An Improved Connection.

Talking about condensers, this time variable air condensers, however, a good method of connection to the moving plates consists in passing a piece of plaited copper wire into the spindle, which is hollow, and securing this wire at the other end to the terminal. When the movable plates are rotated the effect is to twist and untwist the plaited wire, and as this cannot be twisted through any very great angle, it is perfectly well able to stand up to the treatment and gives a perfect connection. It is also very simple, and, no doubt, cheaper and easier to assemble than the pigtail type of connection, which has been so largely used for variable condensers. The pigtail gives a perfectly sound electrical connection, but is apt to get caught up in its surroundings.

Another arrangement used to be the watch-spring connection, which was all very nice mechanically and a very pretty job, but was apt to cause trouble on very short wavelengths.

Useful on Ultra-Short Waves.

This arrangement of the plaited wire passing into the hollow spindle of the movable plates seems to me very good, because it gives perfect flexibility and electrical connection without getting in the way of anything, and without causing any trouble when ultra-short waves are used. In fact, I am informed that condensers made on this principle can be used right down to the wavelengths to be employed for high-definition television, without the slightest difficulty.

Try this Lead-in.

In the early days of broadcasting one of the favourite tricks of experimenters was to use a "condenser lead-in" consisting of two sheets of tinfoil, each about a foot square, pasted in register on opposite sides of a window, the outer sheet being connected to the aerial, and the inner sheet to the aerial terminal of the set. This was used more as a stunt than from necessity. It has its uses, however, in cases where it is impossible or undesirable to drill holes through the woodwork of the window frame, and it can be made to serve quite well.

Capacity of the Aerial.

I have several times seen sets working excellently on an aerial lead-in of this type. You can easily work out for yourself the capacity of the condenser, and if it is insufficient you can increase it by simply increasing the area of the tinfoil sheets.

There are some cases where the insertion of a fixed condenser in the aerial lead-in is an advantage, depending upon the capacity of the outside aerial system. I am not recommending it in cases where it is not necessary, but in those cases where some way of avoiding holes in the woodwork *is* necessary, this arrangement can quite well be used, provided you get the capacity right.

Diode Detectors.

In various types of detection, including the anode-bend and leaky-grid types, the detector acts not only as detector, but also to some extent as amplifier. During the past year or so, the trend of circuit development has been rather towards using two-electrode, or "diode" detectors, which only rectify the high-frequency signal, and do not make any attempt to amplify it. It was always realised that making the detector serve a dual purpose, whilst convenient in some ways, had disadvantages, because the two functions which it has to fulfil are widely separate and it follows that, in the result, *quality* must to some extent be sacrificed. This is one of the reasons why the fashion is swinging back to the use of diode detectors.

In the very early days of valves, simple diode detectors were largely used—in so far as anything was largely used in those days—but since the revival of interest in the two-electrode detector, many circuit designers have specified three-electrode valves serving, however, only this diode purpose.

Multiple-purpose Valves.

In practice this two-electrode valve scheme takes the form of multiple-purpose valves, which employ a set of electrodes for two or more purposes, or, rather, I should say *sets* of electrodes, because in some cases the only electrode which is common to all is the cathode or emitter.

One of the best known of these new types is the double-diode triode, which embraces two diodes and a three-electrode valve in combination. So far as the triode part is concerned, this is similar to the regular type of triode. An electrostatic screen is provided, and this separates two anodes, which surround another part of the cathode, and these, together with the cathode, form the two diodes. The triode part of the arrangement, I forgot to say, is placed towards the opposite end of the cathode from these two diodes.

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This Triode-Hexode is a new frequency-changer of very considerable possibilities. We have two types available, the X41 for A.C. Mains and the X31 for A.C. or D.C. Both are of real interest to every experimenter, and especially to Short Wave and Television enthusiasts, for reasons which we have described in some useful notes on the subject.

G. Marconi

WRITE TO THE VALVE DEPARTMENT, MARCONIPHONE COMPANY LIMITED, 210 TOTTENHAM COURT RD., LONDON, W.1, MENTIONING THIS PAPER.

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Saturday, June 8th, 1935. S.S.

POPULAR WIRELESS, June 15th, 1935.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

SPECIAL ARTICLE: HIGH-POWER "NARROWCASTING"

Popular Wireless

AND TELEVISION TIMES

THIS COMMITTEE BUSINESS

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"SELF-TUNED" RECEIVERS

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Vol. XXVII.
June 15th, 1935.

Preparing for Television

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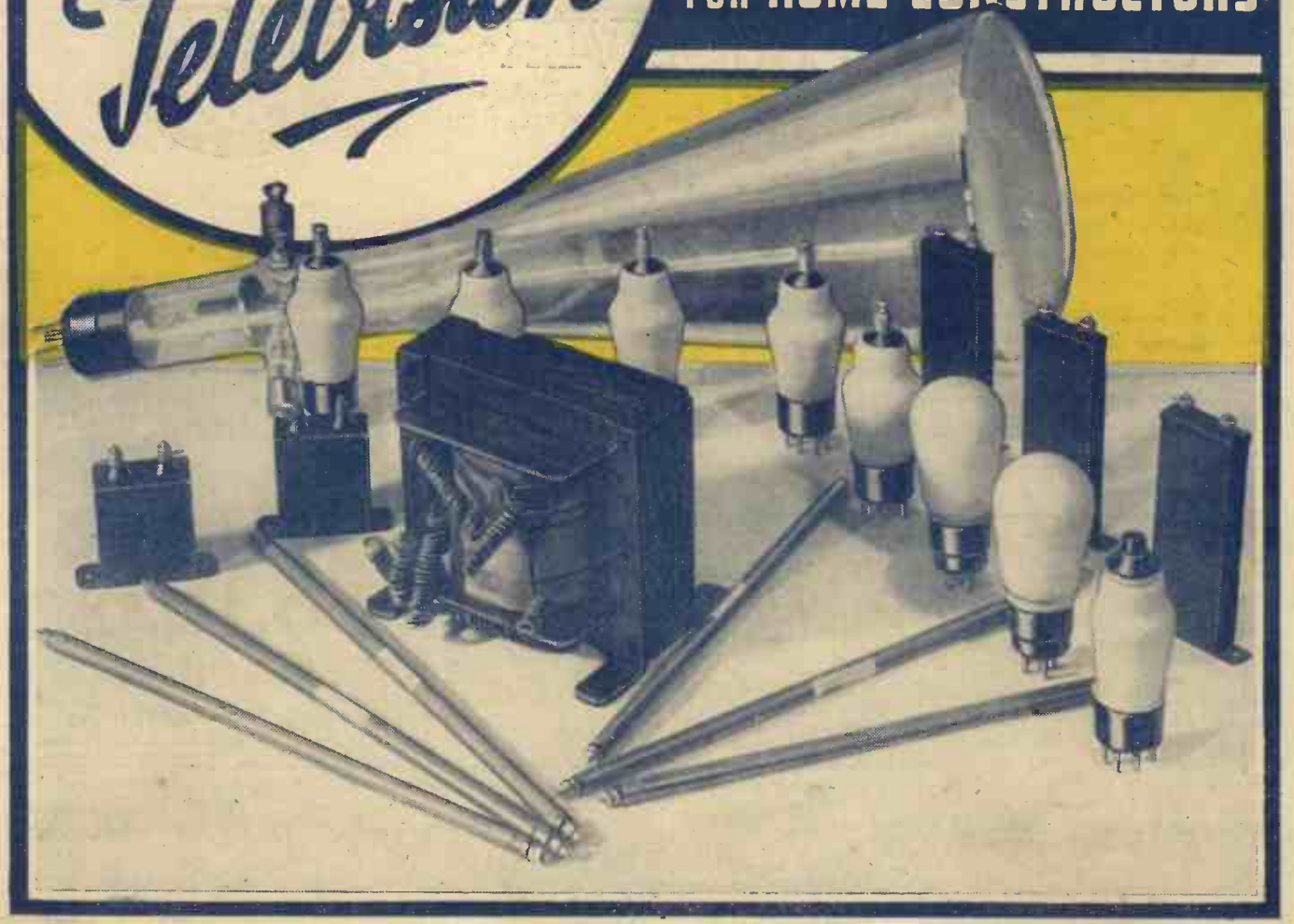

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POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR: N. F. EDWARDS. TECHNICAL EDITOR: G. V. DOWDING, Associate I.E.E.

HOT TESTS ?
NEW MIKES
LOCAL PRIDE
MEMORIES

RADIO NOTES & NEWS

THAT PILLOW!
BEAM RENT
BIG NOISE
IN 1866

What's Going On ?

WHEN I warned you, not long ago, to keep an eye on Marconi's experiments in Italy, I hardly thought they would take the spectacular turn they did. Behind the closed doors of a Rome fort, guarded by sentries, the Marchese demonstrated his latest to a select audience comprising Mussolini himself, the Italian Under-Secretary for War, and his colleague the Inspector-General of Engineers.

Just what they saw nobody else knows, but it was enough to start the biggest crop of rumours since 1914!

It has, however, been authoritatively stated that these experiments did *not* concern the micro-wave tests, which Marconi is also carrying out on the hills outside Rapallo and Monte Burrone, near Leghorn. It is known that the transmitting station at Rapallo is a wooden cabin *covered with asbestos*, so the inference is that these tests also are pretty hot.

About the New Stations.

NEW DELHI expects to get on the air next November, with a power of 20 kilowatts.

* * *

France is building a hot-stuff short-waver at Villejust, Seine-et-Oise, to keep her in touch with America and independent of cables.

* * *

Toulouse and P.T.T.-Nord, the French regionals, were unable to test on the scheduled time because—the human touch—they hadn't enough H.T. on the premises.

* * *

Ribbon Development.

IF the quality of your set were really as good as you think it is, you would have noticed recently an increased naturalness about the programmes. For there has been a technical clean-up in the microphone department at Broadcasting House.

A new supply of microphones of the latest ribbon type is taking the place of the old-timers, and the result has been to take out some of the spurious "background" murmur and improve the reproduction of overtones.

One of the advantages of the ribbon microphone is that it does not have to to be placed just so to hear from a given direction, but it keeps a sharp ear out for sounds from all quarters. Though a listener seldom hears good of himself, the "ribbon" has already had many a compliment addressed to it.

Foster-father B.B.C.

WHO was the brain-waver that suggested that the B.B.C. staff should "adopt" Gateshead in order to combat the unemployment problem there ? He deserves

ON OTHER PAGES

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Self-Tuned Receivers : : : Page 382
Bringing Out Those Top Notes Page 383

to be named and known, for although Gateshead is *not* depressed in the are-we-downhearted sense, it is an area that has been hard hit economically; and a spot of moral support and financial backing will not come amiss to the social service organisations in the borough.

The benefits of the scheme won't be all one-sided, either. Gateshead unemployed can teach the B.B.C. a lot. Some of their slender budgets are marvels of balance and control.

EIGHTY-FOUR TO-DAY

SIR OLIVER LODGE, F.R.S., is eighty-four years of age to-day, June 12th. We feel sure that all "P.W." readers will join us in wishing this famous scientist a very happy birthday.

A Slight Slight.

WE are not all equally well equipped to rough it in the hurly-burly of life, you'll agree; but some folks are so sensitive that it would be a kindness to have them painlessly dotted on the spot.

One of these exquisites has protested against the B.B.C. weather reports because his own locality is too often linked with the phrases "rather cold," "some rain," etc., while other parts of the country are reported as "continuing fair" and "rather warm."

Local pride is all right, but a fellow that carries it to these lengths ought to be made to go to sea, work in a radio-testing shop, or assist lorry-drivers with sulky engines—he would soon cease to care about the slight slight of the meteorologist.

Their Turn

MY recent references to feminine readers of these Notes have brought me several charming letters from interested parties of the fair sex. Since I am much too retiring to reply direct to these, I am glad to be able to announce that Miss Hilda Radish, of 330, Manchester Road, Cubitt Town, Poplar, London, E.14, has been appointed Central and East London representative of the Anglo-American Radio and Television Society.

She will welcome applications for membership from ladies in that area—enclose a stamped, addressed envelope, girls, and get in on all this radio excitement.

War and Peace.

LOOKING through some back numbers of "P.W.," A. M. J., of Marston Green, Birmingham, came across my Note, in our January 26th issue, headed as above, and it brought back old times with a rush. "I believe that you and I," he says, "were in the same fleet during that awful night, as I take it you were referring to the time when the Formidable was torpedoed."

He is mistaken in this, as the fireworks which I witnessed went off a little later in the war. Were any of my readers, however, in that nautical picnic in which the Formidable figured ? If so, I will willingly pass on A. M. J.'s address, for he says, "I have never met anyone since who took part in that patrol, but I would like to do so."

(*Continued on next page.*)

WHAT WAS YOUR CRYSTAL-SET RECORD?

Reposeful Radio.

SUMATRA—that long island that lazes in the sunshine of the Indian Ocean and helps to keep the Malay straight—has gone all scientific. For according to a very respectable-looking newspaper cutting that has been sent to me, Sumatra has given birth to a "revolutionary wireless development."

Accustomed to deal sceptically with such reports, I find that the development in question is a wireless pillow (with 'phones inside) that woos the recumbent ear with music.

Yes, the old stunt has cropped up again. And if anybody else "invents" that confounded pillow I shall seek my own, with a sick headache.

Welcome!

LIFE'S full of surprises, isn't it? When I started to read a letter headed "The Rectory" I not unnaturally thought I was in for a sedate and stately epistle, possibly a reproof for my levity in print.

Instead, this worthy padre starts off with a lively pun on the first page, pulls my leg about crystal sets, asks after "Arieline" and the garden, and ends up with a pæan of praise for the S.T.500.

"Ends up" did I say? No, sir. There is a P.S.—rejoicing in the return of the Two Bright Lads—which says "We have been Clapham and Dwyer-less too long!" I don't know what the parishioners think of all this, but it's honey and waffles to a conscientious scribe. Yes, we all of us rejoice at the return of our two friends to the mike.

How to Achieve Fame.

PICKING at random an ordinary-looking letter from my postbag, I blinked to see a famous name at the foot, followed (alas!) by a request that this name should not be published. This is a thousand pities, because it is seldom a great scientist swims into our correspondence pool. And the surprising bait that attracted this Big Fish was my remarks on crystal-set records.

He points out—what I had overlooked—that unless the question of the crystal set's longest range is settled pretty soon, posterity will never know the facts; for the web of radio communications that is now encircling the globe will never cease, and our grandchildren will have so many transmitters and valves going that straightforward crystal-set records will be out of the question for all time.

So all long-distance record-claimers are invited to submit their distances—maybe the last chance they will ever get of placing their names on the Roll of History.

Rent Restriction.

"YOUR recent remarks about the rent paid to the Post Office for the beam stations seem to have stirred 'em up," writes a Norwich correspondent, when enclosing a cutting from a financial newspaper. This shows that since 1930 the P.O. has collected over one and a quarter million pounds for the rent of its radio beams—enough to make other landlords feel their own poor efforts are mere philanthropy.

Some day, I suppose, something will be done about it. But, in the meantime, let us admit that to its other accomplishments the P.O. can add the claim that it knows the game of Financial Sting-O from A to Z.

BROADCASTING TOPICALITIES

Held annually at Olympia, the International Horse Show has many spectacular events, but none of them claims the attention of the public as much as the competition for the King George V. Gold Cup. It is a competition of superlative excellence, in which the finest military riders and jumpers in the world compete.

On June 24th Major H. F. Faudel-Phillips, one of the greatest masters of horsemanship in the country, will give a running commentary on this outstanding sporting event, which will be relayed from Olympia in the National Programme.

* * *

The sixteenth annual display of the Royal Air Force at Hendon Aerodrome takes place on June 29th. The running commentary broadcast to listeners on previous occasions by Squadron-Leader W. Helmore aroused great interest, and this officer will again be heard at the microphone this year. The principal points from this year's broadcast will be: Aerial Skittles; Air Drill; and Low Flying Attack.

* * *

Dr. Adrian Boult, Director of Music of the B.B.C., will be in Birmingham on June 21st to conduct the B.B.C. Midland Orchestra's Friday afternoon symphony concert. The programme includes Mozart's Jupiter Symphony and Arnold Foster's Concerto on English Folk Tunes, with Michael Mullinar as the pianist.

* * *

The T.T. races in the Isle of Man are to be well covered in the Northern programme this year. Graham Walker, the famous racing motor-cyclist, will broadcast eye-witness accounts of the Junior event on June 17th, and of the Lightweight on the 19th. To maintain a running commentary on the Senior race (open to engines of 500 c.c.) on June 21st, four commentators will be used—Graham Walker and Victor Smythe will be stationed at the Grandstand, Glencrutchery Road, James Tovey will be at the Ramsay Hairpin, and George Brown at the Creg-na-Baa.

Audibility—Good.

OLD Contemptibles, reservists, and other survivors from the Great Unpleasantness of 1914–18 will sympathise with the B.B.C.'s Director of Outside Broadcasts—in his task at the Spithead naval review.

This will be the first broadcast commentary from a battleship, and the difficulties of the relay are unusual; for the microphones, sensitive to even a distant polite sneeze, will have to behave with equanimity during gunfire at close quarters.

In these occasions, as may be imagined, the level of audibility is distinctly higher than the average. And if the O.B. Director succeeds in putting over the effects of the salutes, he will deserve one himself!

The First Ever.

OLD hands at the radio game will remember that some years ago a nice little controversy boiled up as to which was the first sea newspaper. All the entrants have now been back-dated by the discovery of "The Great Eastern Telegraph," which was issued on the cable-layer Great Eastern while she was doing her trans-Atlantic stuff way back in 1866.

The Editor of that journal—he had to *write* out all the news, in longhand, poor chap!—modestly claimed that it was an epitome of Political, Social, Ecclesiastical, Military, Naval, Legal, Medical, Artistic, Literary, Dramatic, Commercial, Electrical, Sporting, Geographical, Zoological, Mythological, and General Intelligence!

Among the 1866 news items are a murder at Brighton, traffic hold-up in the City, trains late from Cannon Street, and the First Lord of the Admiralty admitting that "England is behind other nations."

Who said Progress?

Birthday Honours.

LIKE many an appeciative listener, I was delighted to find that the Birthday Honours List included some delightful bouquets for broadcasting personalities.

Mr. Noel Ashbridge, for six years Chief Engineer of the B.B.C., receives a Knighthood; the director of school talks, Miss Mary Somerville, has been awarded the O.B.E., and Mr. Gerald Cock, who has been so successful as O.B. director, receives the M.V.O. It was to Mr. Gerald Cock that fell the onerous task of attending the King during his world broadcasts.

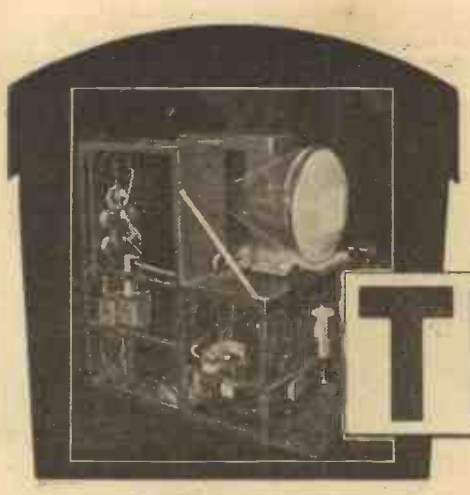
Teletactile Thrills.

YOU'VE heard of Dr. Alfred N. Goldsmith, Consulting Engineer of the Radio Corporation of America? According to the "Bombay Radio News" the worthy Doc. suggests that in the remote future radio may appeal not only to ear and eye, but also to touch, taste and smell. And there is a possibility of transmitting three-dimensional replicas of objects in the studio. (You will be able to look at them, listen, and *touch!*)

"Telegustatory Broadcasting" will allow the set-owner to taste, say, a fine cup of coffee; while a "Telefactory Receiver" would spray into the air a duplicate scent.

You may smell a rat when the Doc. goes on to say these possibilities are at present "only whimsical and remote imaginations."

ARIEL.



Preparing for TELEVISION

A brief review of some of the outstanding components that are being made for use in the home construction of high-definition television receivers.

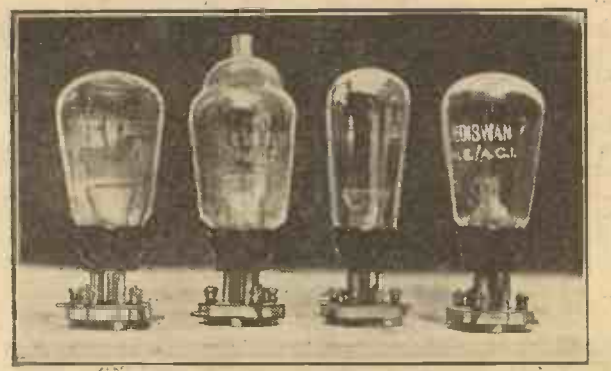
By K. D. ROGERS.

ALTHOUGH up to the time of writing we have been treated with a long reign of silence after the findings of the television committee, there is plenty of activity going on behind the scenes.

We may not have had any official intimation as to when and where the television station for London is going to be built, nor indeed, of the exact types of transmissions that will be employed. But such information appears imminent, and you may know by the time you read this.

A wide diversity of apparatus is available at the moment for those who want to carry out television research, though owing to the fact that there is no great demand at present the parts are not normally listed in the catalogues in many cases and are obtainable to order only.

SPECIAL TYPES OF VALVES



A row of special valves that are designed by Ediswan for cathode-ray television reception. From left to right they are: MU1 (1,500-v. mercury rectifier); MU2 (4,000-v. mercury rectifier); DLS1 (vacuum thermal-delay switch); and HE/AC1 (helium-filled gas-discharge valve). The valve holders are the Bulgin "Frequentite" short-wave type, which are excellent for high-voltage circuits.

This state of affairs is inevitable, for it is obvious that with such things as television power-transformers it is impossible to go into production with a range when the final requirements of the television constructor are not known.

Many Scanning Circuits.

There are so many different forms of scanning circuits for cathode-ray television that no fixed details of the transformers and the smoothing chokes can be determined. Some exciter circuits require potentials of 2,000 volts, others with larger tubes need 4,000 volts. Resistance-fed gas-filled relay valve circuits need 1,000 to 1,500 volts supply and about 15 milliamps, while "hard" time base circuits may want 800 volts and up to 120 milliamps.

On top of this there are all sorts of requirements of L.T. current for the discharge valves, and the associated amplifiers and control valves, while there is also the question of the cathode tube itself.

This latter may want ·4 volt and about 1 amp. of D.C., or it may require 1·5 amps. of A.C. at somewhere round about 2 volts. The heaters of the valves in the time bases may require just one L.T. winding on the transformer, giving, perhaps, some 5 or 6 amps. at 4 volts, or they may need a group of windings so that the heaters may be electrically separated, and then they may want anything up to 6 or 7 amps.

No Standardisation.

So far no question of the standardisation of time bases has been raised. They obviously cannot be standardised at the moment with so much still in the air regarding television, and therefore the various firms that carry out the construction of transformers for television have to wait for their orders and build the transformers according to the requirements of the experimenters.

Such firms as W. B. Savage, Sound Sales, and Andrew Bryce are in the forefront with speedy supply of experimenters' transformers—good strong pieces of apparatus that are well able to stand up to the electrical strains that are imposed on them. And the design of a 4,000-volt transformer is no small matter!

Chokes, too, are made by these same firms for television purposes. You have only to give the order and the requirements and the apparatus will be along in very short time. Not that the ordinary transformer and choke makers do not supply television parts to individual order, but the firms mentioned specialise in such work, and to them must naturally be given every credit for their foresight.

Some Suitable Chokes.

Harking back to the matter of chokes, it is not so necessary to have a specially constructed job as in the case of transformers, for it is not, as a rule, difficult to find a choke that is suitable in the lists of one or other of the well-known choke-makers such as Varley, Wearite, Heayberd, or Ferranti. Certain tuned filter chokes for synchronising amplification may have to be ordered specially, and Colvern are, I believe, ready to tackle these. So are the Radio Reconstruction Co., of Conduit Street, London, who have made tuned transformers for 30-line television synchronising circuits for quite a long time.

I am dealing first with the cathode-ray exciter and time base side of television

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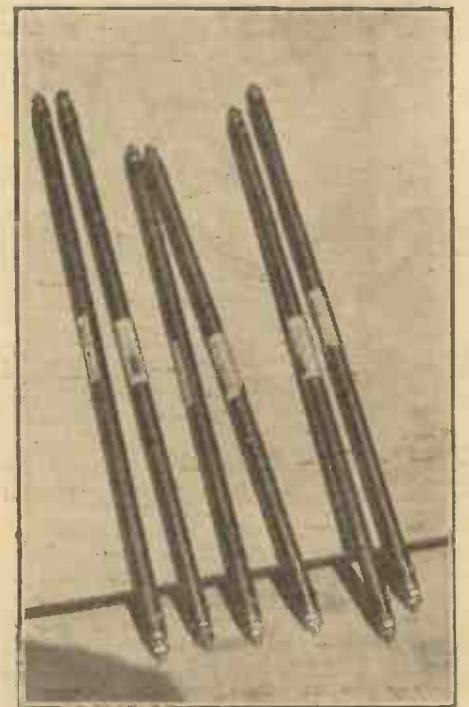
HIGH-VOLTAGE RECTIFIERS



These are not resistances, but low-current high-voltage dry rectifiers made by Westinghouse. Voltages up to 4,000 can be easily obtained by voltage-doubling circuits with four or six of these in series.

PREPARING FOR TELEVISION

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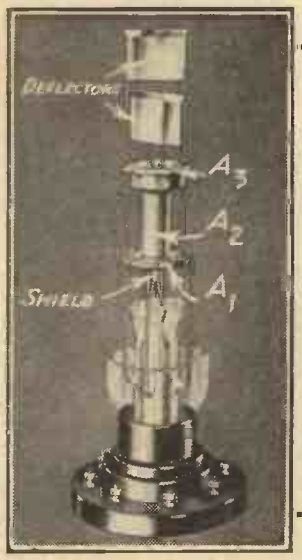
because it is in this connection that most of the work has been done, and it is in this section of television that the parts are easiest to obtain. If you go along and try to get a high-definition ultra-short-wave



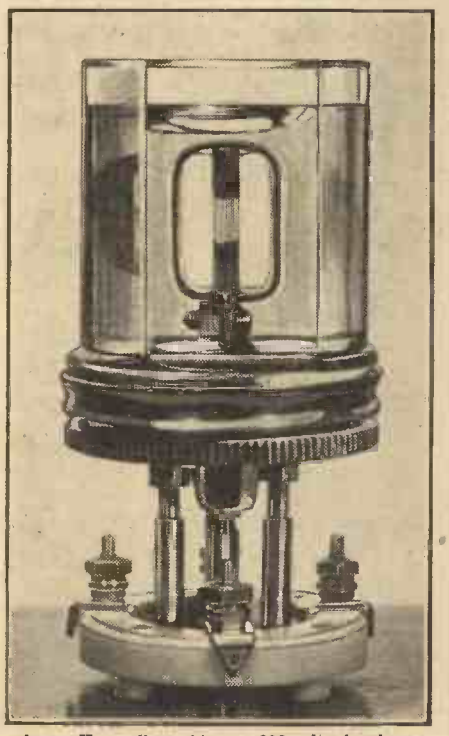
IN THE TUBE

The arrangement of electrodes in the Cossor three-gun cathode-ray tubes. Bias and modulation are applied to the shield surrounding the cathode, and increasing steps of high voltage, culminating in 3,000–4,000 volts, on the three anodes—or guns A_1, A_2 and A_3. Scanning is carried out by the two pairs of deflectors.

intermediate transformer, for instance, you will be disappointed at the moment.

Not that work on such matters has not been done. A great deal of activity in the radio side has been going on for a long time, but all the makers, Eddystone, Burne-Jones, Colvern, and so forth, are keeping their designs well under their hats. They will, of course, make anything up to individual specification.

MECHANICAL SYSTEMS



A new Kerr cell, working on 300 volts, has been made by B.T.S. for home constructors who are interested in mechanical television systems.

Di-Pole Aerial.

One very recent release for short-wave workers who are interested in the reception of 5 to 7 metres, and therefore of interest to television experimenters, is the special di-pole aerial kit made by B.T.S.

This kit is primarily intended for horizontal suspension, though it could be used as a vertical type if desired. It consists of accurately cut lengths of stranded copper wire, with a spring suspension anchorage and two glass insulators.

The feed wires are also provided, together with the ebonite spreaders, while a tuning unit and coupling coil complete the outfit.

At the moment of writing the price has not been settled, but I understand it will be very competitive, and the outfit should prove of exceptional interest and value to short-wave enthusiasts.

But to return to the cathode-ray side. The valve and cathode tube departments are well catered for by Cossor and Ediswan. Besides the tubes themselves, both supply gas-filled relay valves, the latter having a high-speed type in which helium is used instead of mercury, neon or argon. The G.E.C. also come into the picture where the valves and the gas-filled relays are concerned, but so far their cathode-ray tubes are a bit expensive for the ordinary man in the street, and I do not believe they are made for general sale at the moment.

Now Available.

Cossor tubes, however, are available, and so are those by Ediswan. Both have sepia hard types, and Cossor also have a blue and white tube. The Cossor tubes all have three anodes, while the Ediswan types have two. Large and small tubes are available from each firm, though at the moment I believe that Cossor have reached a greater maximum diameter than Ediswan.

Do not let that last statement be misconstrued, however; it is not a matter of sheer merit that enables a large diameter tube to be made. Huge great tubes could be constructed, if desired, but it is a question of the likely demand that governs the actions of the manufacturers. It is no use making a 20-in. diameter tube, for instance, if no one is going to need it. And there will be a limit to the size of tube used in home televiewers. What that size will be is a matter of opinion, and here is where the various tube makers have differed so far.

I believe that Cossor are looking forward to a large sale in tubes that will give a picture of 10 in. by 8 in., while Ediswan rather lean to the opinion that a tube giving a picture of 8 in. by 6 in. will be all that the general public will require, and all they will be likely to afford. For it must not be forgotten that the larger the tube the greater the price, and the greater the scanning voltages required to operate it. Anyhow, the question of tube sizes need not worry us here. Suffice it to say that excellent tubes can be obtained from both firms from prices of about eight guineas to 15 guineas, and as sales develop and

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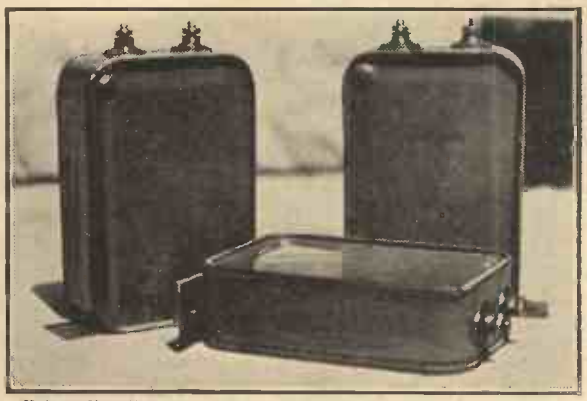
THEY ARE FULL OF OIL

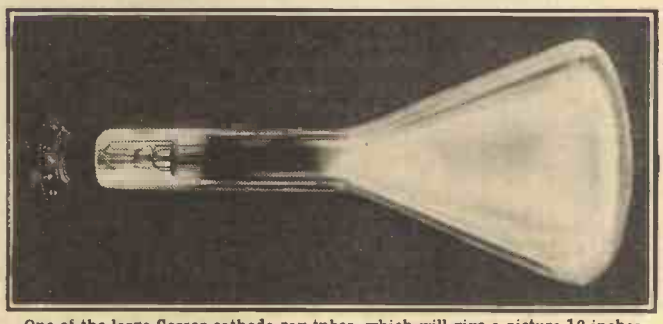


Not sardine tins, but Dubilier oil-immersed 2,000-volt condensers. Types for voltages up to 4,000 are made by this well-known firm and have a very high margin of safety.

FOR HIGH VOLTAGE

Mains transformers made for high-voltage circuits. The two outside ones are Sound Sales dry rectifier transformers, and the inside pair are W.B. Savage designs for valve rectifier circuits.

GIVES A TEN-INCH PICTURE



One of the large Cossor cathode-ray tubes, which will give a picture 10 inches across. It takes 4,000 volts on the third anode and requires a total deflector scanning potential of about 1,400 volts for full deflection.

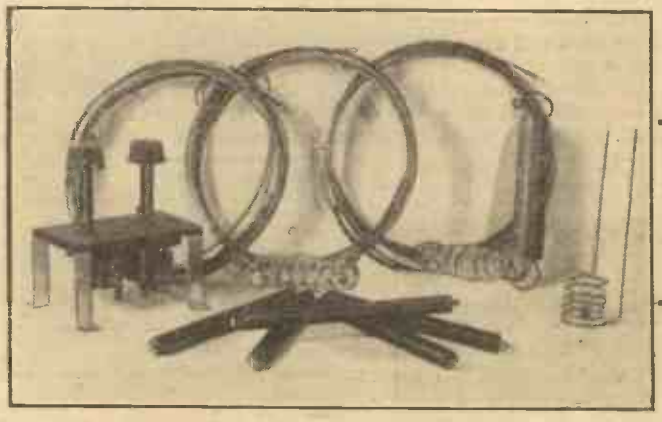
PREPARING FOR TELEVISION

(Continued from previous page.)

television comes in, these prices may be expected to fall considerably.

Special rectifier valves for the cathode-ray tube exciter unit, handling up to 4,000 volts, are made by Cossor and Ediswan, and the M.U.2 mercury vapour rectifier is a good example.

But the valve makers have not got it all their own way in this regard. Westinghouse have prepared a series of high-voltage, low-current dry rectifiers, such as the H.176, which, with voltage doubling,



will give up to 3,000 volts quite easily. The transformers for the dry rectifiers are available from the makers mentioned, and I have had some excellent ones from Sound Sales; they are illustrated in one of the photographs with some Savage valve-rectifier transformers.

High-Voltage Condensers.

But the transformers and valves are not the only parts that come into television work. There are such items as condensers, and here, too, special types have been evolved to withstand the high voltages. Dubilier have gone in for oil-immersed condensers and make them with voltage ratings up to 4,000 volts. T.C.C. use a petroleum jelly impregnation and make condensers up to 1,500 volts, though probably by the time this appears plans will be well forward for models to stand higher voltages than that.

T.M.C.-Hydra are also in production with petroleum jelly condensers, or something very similar, while their ordinary types are extended in range to bring them into line with some of the smaller voltage requirements of television. We have, therefore, such items as the 4- and 6-mfd. types with working voltages up to 1,000.

A fourth condenser maker is Andrew Bryce, who has recently placed on the market types for voltages up to 2,000. These high-voltage condensers have to be most carefully tested at every stage of their construction, for a fault may mean not only that the condenser will break down, but that in certain cases the cathode-ray tube will be ruined. Not a very light responsibility for the condenser maker to have to shoulder!

Potentiometers are in great demand for television purposes, and values of from 2,000 ohms up to a megohm are required in some cases. One of the most energetic firms in the preparation of suitable wire-wound and specially smooth action controls is the Reliance Manufacturing Company, whose potentiometers have long been used by Ediswan in their research work. For "hard" time base work where comparatively large currents may be present we find the Varley power potentiometers exceedingly useful, the C.P. types being ideal.

Another make of potentiometer that I have tested in television circuits is that made by Polar-N.S.F., and a particularly smooth action is provided by their products. So far, they have not gone into the television market in any direct way, the potentiometers available being only those normally stocked for radio purposes, but probably when things get a little more settled the N.S.F. controls will take their place in the front row of the television potentiometer ranges.

Importance of Good Resistances.

Fixed resistances of complete reliability are necessary for television, especially in such cases as the cathode-ray tube exciter unit potentiometer chain. If this chain breaks, due to a faulty resistance, it may, in certain cases, mean death to the tube, so that the resistances used must not only be of the correct wattage but of first-class manufacture.

Here we have Dubilier and Erie to rely on. Both make resistances that will stand the specified wattage and some more in hand, while the values are closely accurate and the manufacture such that complete reliance can be placed on the products.

"Valve holders for television" may sound rather an absurd suggestion. But it is a fact that, though special valve holders do not have to be made expressly for television, it is advisable in the high-voltage circuits to use the low-loss type of valve holder, such as the short-wave type. Bulgin and Eddystone assist us here, and there are available not only the five-pin variety but also the seven-pin type, making them particularly useful for those who are using pentode-fed discharge valves in their apparatus.

I suppose that it will not be expected that in this brief survey of the components made for and available for television I should mention terminals. But it is a fact that when dealing with the high voltages, such as are experienced in cathode-ray work, it is essential that the terminals.

(Continued on page 390.)

CONSTANT INDUCTANCE

These are 50-mfd., 120-m/a. chokes made by Andrew Bryce, and are ideal for time base smoothing circuits using hard valves. The choke resistance is only 300 ohms.

FOR "ULTRA-SHORTS"

A special new di-pole aerial kit marketed by B.T.S. for the reception of wavelengths round 5 to 7 metres.

JELLY FILLED

New T.C.C. high-voltage condensers in which petroleum jelly is used to enable voltages up to 1,500 and more to be dealt with in perfect safety.

MORE SPECIAL COMPONENTS

T.M.C. Hydra 1,000-volt working condensers and a special Wearite low-tension choke are shown here. The choke was designed for L.T. rectifier smoothing for cathode-ray filament circuits. It is used in conjunction with 2,000 mfd. electrolytic smoothing condensers.

BARRY KENT CALLING

News and Views from the "Big House."

AMONG my listener correspondents and readers there is a sudden increase in demand for more broadcasting personalities from the B.B.C. People are complaining that Broadcasting House is sinking into a kind of deadness that is unrelieved. I believe this criticism is well founded and am making representations to that effect.

I have told Gladstone Murray that when he shortly assumes his new programme job I shall expect to hear him applying this doctrine of personality that he has avowed as public relations officer of the B.B.C. Incidentally, if some of the pundits would descend to grace the mike, programmes would benefit, and mistakes would not bulk so much.

* * *

Lady Snowden Again.

Now that Mr. Baldwin is reassuming the Premiership, it is rumoured in usually well-informed political circles that he would not be averse from inviting Lady Snowden to rejoin the Board of Governors of the B.B.C. when it is reconstructed after the Report of the Ullswater Committee.

There would be an overlap of a year with Mrs. Mary Hamilton, but the presence of two women on the Board is considered as possibly a popular move. Anyway, it is interesting to observe that the B.B.C. Governorships are still regarded as non-party appointments.

* * *

Big Dance Band Shake-up.

Roger Eckersley has just about finished his plans for a big radio dance band shake-up this autumn. More bands are to be relayed regularly, including in particular the new Savoy Orpheans. There is also a strong possibility, almost a probability, of a new B.B.C. dance band. This will not affect Henry Hall; indeed, it will give him more to do, because he will be in charge of both the new and the old bands, if and when the present plan materialises.

* * *

B.B.C. Religion.

I have been trying without much success to unravel the mystery of just how the B.B.C. manages to justify the elimination of such branches of religion as Christian Science and Spiritualism from its broadcasts. Of course, the official attitude is to throw the responsibility back on the Religious Advisory Committees; but these consist of representatives of the Churches that are admitted, and as a "close combine" they cannot be expected to welcome a further splitting up of the available time.

Anyway, the B.B.C. does let in the Unitarians by some formula that the Advisory Committee is not responsible for. And while I am on the subject I would like to put in a word for the Free-Thinkers and the Society of Ethics. Why shouldn't they all have a go in due season and in right degree? If, as I think, the case for Christianity has nothing to fear, then let all serious views be ventilated.

THE "GANG" LEADER

HUGHIE GREEN and one of his "gang" in a "love scene" before the mike. This photograph was taken while Hughie was appearing at a theatre in Manchester.

B.B.C. Crosses Street.

Not satisfied with absorbing several houses on its own side of Portland Place, the B.B.C. is now planning to invade the other side of the street, where Number 25, among other houses, is being absorbed as soon as present occupants can be induced to quit. I wonder what will be the limits of this territorial expansion.

* * *

Manchester's New Studios.

The new studios at Manchester, which were opened this week, mark another stage in the development of regional broadcasting. The North of England is in many respects the best equipped of the B.B.C. Regions. Broadcasting House at Manchester is now more up-to-date in technical apparatus than Broadcasting House in London. Programmes are well executed and admirably adapted to the listening public in that they allow good scope for local aspirations and susceptibilities.

* * *

Pickwick Centenary.

March 31st, 1936, is the centenary of Pickwick. The B.B.C. has decided to mark the occasion with a feature programme, which probably will be entrusted to Mr. Clinton Baddeley.

* * *

The King's Message.

The King has sent a special personal message of thanks and appreciation to all those concerned in the arranging and broadcasting of the Jubilee programmes.

You have already read on page 370 that his Majesty has honoured Gerald Cock, who was responsible for the O.B. side.

THOSE SIMPLE PLAYS.

Our broadcasting critic has a few words to say about "Wedding Group" among other recent programme items.

PHILIP WADE'S "Wedding Group" wasn't a disappointment. Forewarned is forearmed. The author had told us that his play was to be a simple affair. So we didn't sit down to it with the same thrill as we do at the theatre. The rise of the curtain on this occasion was not the big moment of the day. "Wedding Group" was interesting, but it could have been told as a story pure and simple. There were attempts at characterisation. But on the whole, the play had all the ingredients of the simple play, mixed according to a well-known formula.

* * *

There's rarely any excitement in these plays, for we know from the start what is going to happen. It is amazing after several years of listening that listeners aren't yet acknowledged to be intelligent. I am all against these simple presentations and expositions. I am thinking of the departure scene in "Wedding Group." This scene ought never to have been. Acknowledged story-tellers aren't usually the disciples of simplicity. They keep us constantly guessing. They side-track, returning later to the main theme. And our pleasure and understanding are not jeopardised because of it. The play and the story have much in common.

* * *

There seems to be no reason why plays of the "Wedding Group" calibre shouldn't be turned out by the score. For all this, there were features in this production that I quite liked. I liked Gladys Young in the preliminary scene. I always do like her. I don't remember her playing the rôle of quite so old a lady as Mrs. Wilde. She did this very well. I also liked J. Hubert Leslie as the Presbyterian minister. Whatever Robert Speaight plays I like. Again, the effects were good, and, best feature of all, all the voices were crisp and resonant.

* * *

Philip Wade is a prolific broadcaster. There are few productions, it seems, whose programmes his name does not adorn. He has played many parts, big and small. I should say he is better known to listeners as an actor than a playwright. This isn't surprising when one recalls that he is credited with having played well over 200 parts since his first broadcast in 1925. His plays number in comparison very few, the best and most successful of which was "Family Tree," broadcast three years ago.

* * *

An interesting talk this week was the ninth in the series on "Freedom." It was more interesting,

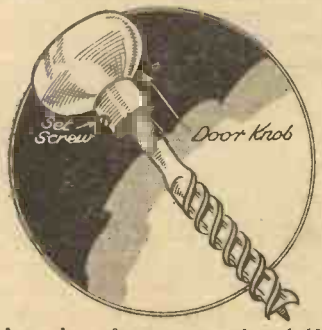
(*Continued on page* 392.)

RECOMMENDED WRINKLES

FOR HOLDING DRILLS.

MANY constructors use the ordinary ⅛-in. brace-bit for wooden pancls, etc., but perhaps not sufficiently to warrant the expense of a brace. The bits can be bought at a sixpenny store, and an efficient and cheap method of turning them is found in the following:

Obtain an ordinary door-knob of the type having a set-screw, and it will be found that the square spindle hole in the knob is a good fit for the square shank of the bit, and that it makes a



A novel use for a common household article.

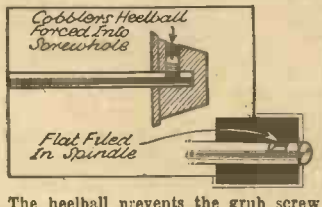
very comfortable grip for turning it. A small V filed in the square shank to take the set-screw makes the knob fast and permits of easy withdrawal from the wood.

The method is also invaluable for boring where the ordinary brace cannot be revolved.

SECURING KNOBS.

ONE of the minor annoyances of radio is the knack that the knobs of volume control and reaction condensers, etc., have of sometimes working loose. The accompanying sketch shows how I overcame this trouble on my set.

Remove the knob and file a small flat on the spindle where the grub screw makes contact. Having done this, replace the knob and tighten up the screw. Then melt a little cobbler's heel-ball into the screw hole, forcing it well down on to the head of the screw.



The heelball prevents the grub screw from turning.

When set you will find it is impossible to make the knob slip. Should it have to be removed at any time, heat an old screwdriver and press in screw hole, turning it slowly until it drops into head of the screw.

SAFEGUARDING YOUR OUTPUT VALVE.

WE all know the disastrous effects a complete absence of grid bias has on the usual type of output valve, especially if it be a power pentode or super-power valve. In fact every valve manufacturer emphasises the risk we run if we work these types of valves for only a few seconds without adequate grid bias.

So, consequently, anything we can do to minimise the risk is worth while. All that is needed is a 1-mfd., or preferably a 2-mfd. condenser, which is between the output valve's grid-bias tapping—usually the highest—and earth.

In this position it acts as a reservoir condenser, and should the G.B. plug be accidentally withdrawn from the battery the valve will not go up "in the air," as would otherwise be the case.

A milliammeter in circuit will prove to you exactly what happens. The anode current will stay just the same without rising for several seconds on withdrawing the plug, and then the milliamps will gradually rise until the maximum is reached, instead of rising instantaneously in the usual way.

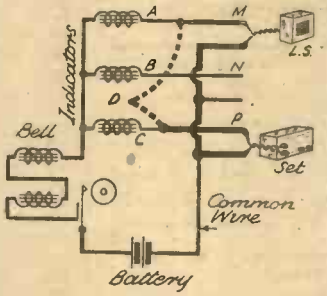
Obviously, it is important to replace the G.B. plug before the maximum is reached; but, meanwhile, you have ample time to replace it and so save your valve.

Further, a blocking condenser in this position will tend to prevent feed-back through your grid-bias battery, and so stabilise your set; so its addition is doubly worth while.

BELL-WIRING EXTENSIONS.

I HAVE found the following scheme invaluable, and I am sure others will find it very useful and economical. Many houses are equipped with an electric-bell system, with bell-pushes in several rooms. The system is usually wired up as in the diagram.

Now it is seen that one side of each pair of terminals is joined to a common wire. It only remains to disconnect A and C and twist them together at D, as shown by dotted lines, and there is a direct circuit between



How bell wiring may be used for a loud-speaker extension.

the two pushes. Hence we have free a low capacity, low resistance and sometimes screened extension to any room fitted with a bell-push. The remaining bell-pushes still function as before.

REMOVING RUST.

ALTHOUGH not essentially a radio idea, the removal of rust is itself a problem well worth solving, and does sometimes occur in wireless work. Here is an easy way to remove rust effectively, permanently and inexpensively.

Get some phosphoric acid, half a pint (syrupy, S.G. 1·750), methylated spirit, an old rubber sponge, a small wire brush and a pair of household rubber gloves. Mix one part of acid to four parts of spirit (more or less acid according to condition of work).

Put on your gloves and apply mixture to work with rubber sponge. Leave on until rust is dissolved (usually one to three hours), rub lightly with wire brush and finally wash off with warm, soapy water. Rinse off in clean water, dry and paint immediately, if desired. The old rust will have gone, and, unless exposure to the weather occurs, rust cannot form again.

A TERMINAL TIGHTENER.

MOST components nowadays have small terminal heads instead of nuts. They are of standard size, but so close up to projecting parts that when fixed in the set are difficult to tighten up with the fingers. Even

This instrument is easy to use and ensures tight connections.

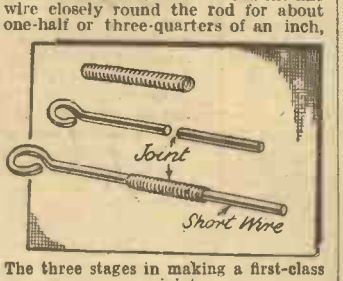
when the heads are not all standard, a tool such as follows will be found useful.

It consists of a piece of tubing long enough to attach a handle—a file handle suits well enough. One end of the tube is tapered out on the inside, as shown, to fit over the terminal head just at the extreme end. The taper is made by swelling out with a taper drift or by turning in a lathe. The inside is knurled or roughened with the taper end of a rat-tail file rolled over the surface of contact. With two tools of different size many sizes of terminal head can be tightened up satisfactorily and with the minimum of fumbling.

FOR BETTER CONNECTIONS.

WHEN building or rebuilding wireless sets it often happens that a wire is too short to reach its terminal or to make a good joint.

Take a length of fine brass or copper wire and a stiff rod about the gauge of the wire that is short. Wind the fine wire closely round the rod for about one-half or three-quarters of an inch,



The three stages in making a first-class joint.

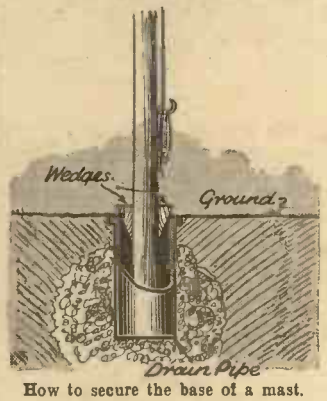
slip it off and you will have a spring tube.

Trim the ends off neatly. If your wire is wanted for a terminal make a wire ring the same gauge as short wire. The spring tube may now be slipped over the short wire and the looped wire, and the two ends brought together.

Then, after brushing over with a little spirits of salts or Fluxite, the soldering iron will do the rest. After a little practice very good joints can be made. Any kind of connection can be made in this way.

SAFE WIRELESS POLES.

FOR a strong ground fixture purchase a drain-pipe, size 3 ft. by 10 in. (approx.). Dig a hole and insert pipe vertically. Pack stones and rubble concrete around base of

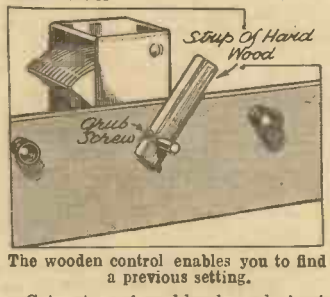


How to secure the base of a mast.

pipe, to make rigid. Place the pole inside the pipe and centre it with four wooden wedges, knocked in tight around top of pipe. Now place soil back and pack hard around pipe.

A SETTING INDICATOR.

A VERY useful tip to regulate the "tone control" or "extractor condenser" when these are placed at the back of cabinet, as in the S.T.600, is to replace the usual knob with a short strip of wood, so as to act like a lever. By this method it is quite easy to know the exact position of the condenser vanes.



The wooden control enables you to find a previous setting.

Cut a piece of good hard wood about 2½ in. long, ¾ in. wide and ⅜ in. thick, bore a small hole ¼ in. from one end to fit exactly over condenser spindle, and above this insert a small brass screw (with sharp end filed off), which will act as a grub screw. Now fix this on in place of the usual knob, when condenser is fully closed, care being taken that the long end of lever is correct length to pass by any adjacent terminals, as shown in the accompanying sketch.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others published will be paid for at our usual rates.

Each hint must be on a separate piece of paper, written on one side of the page. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear?

A SIMPLE HIGH-VOLTAGE METER

Some practical details that will be of interest to the experimenter.

OWNERS of large radio-gramophones have become accustomed to H.T. voltages of round about 400 or 500, and many of them may have meters that will read up to those figures.

Television, with the cathode-ray tube, means voltages of five or six times those mentioned above, and the voltages must be checked if proper operation is to be obtained.

This means that a special meter has to be obtained, and this must either be bought or converted from another meter. But let me explain.

For television measurements up to 3,000 (or even more) volts are necessary, and an electrostatic meter is an essential part of the experimenter's equipment.

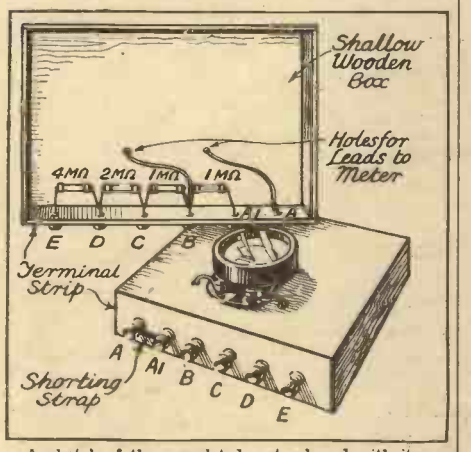
Electrostatic Type Essential.

One must not draw a large meter current owing to the high-resistance potentiometer schemes that are used, and so this type of measuring instrument is essential. But there is no need to buy a high-voltage meter for the purpose of television measurements; a low-voltage type will do quite well.

When we say low voltage we mean something round about 400 volts, and some of you may have such meters that you use for your radio checking. These meters, provided they are of the electrostatic type, are perfectly satisfactory for measurements up to 3,000 and more. Ordinary meters are likely to draw too much current for our purpose and so render the readings very inaccurate.

Let me tell you of a small and simple

A COMPACT UNIT



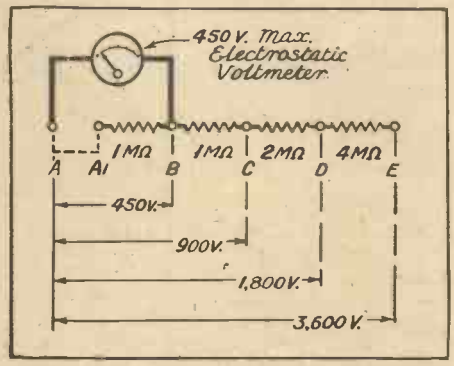
A sketch of the completed meter board with its four resistances.

unit that I made for television experiments. The meter as bought is a Ferranti 450-volt maximum electrostatic type. Now it reads up to 3,600 volts in four steps, covering everything from 100 to that high figure.

All I have done is to build a small unit such as that shown in the sketch, and containing, besides the meter, which is on the top, six terminals and four resistances. The cost of the change, exclusive of bits of wood and a terminal strip of ebonite, is four shillings for the resistances and eighteenpence for the terminals.

The theoretical circuit shows the principle of the thing. A potentiometer scheme of known resistances is constructed, and the meter is tapped across a constant portion of this. Actually I have also arranged for the meter to be used without any shunt

RESISTANCE CIRCUIT



How the voltages are tapped into the potentiometer scheme.

resistance so as to get a dead accurate reading on low voltages, but a shorting strap replaces the resistance and gets the meter ready for high-voltage work. In such measurements the current drawn by the resistances is only about ·6 milliamp for full-scale deflection.

The meter is left tapped across the 1-megohm resistance, and other resistances of 1, 2 and 4 megohms are placed in series with the first one, the junction points being brought out to terminals.

The voltage to be measured is applied to the requisite taps, and the meter is read direct in multiples. Thus, for a maximum of 450 volts terminals A and B are used, and the meter reading is read straight off.

Increasing the Range.

For 900 volts maximum A and C are used with A joined to A1 and the meter reading figure is doubled; for 1,800 volts A and D are used, with A and A1 joined, and the reading is multiplied by four; for the last scale the reading is multiplied by eight and terminals A and E are used, with A connected to A1. This will read up to 3,600 volts.

Obviously by adding more resistances the reading could be still further increased in its maximum, but for most purposes in television the 3,600 is sufficient. Some of the larger tubes need 4,000 volts, and the meter scheme could easily be adapted to meet this requirement.

It should be noted that the voltage is the movable factor, not the meter, as is usual. Instead of the meter being applied across the voltage to be measured, the voltage is applied across the appropriate tap. If you are in doubt about the voltage, start at the top tap and work down till you get the right range.

K. D. R.

AN INTERESTING NEW VALVE

The triode-hexode which is particularly suitable for short-wave work.

ONE of the most outstanding of modern valves is the special mixer that has just been released by the Marconi and Osram valve companies. It is a triode-hexode, and has been designed for use in superheterodyne circuits, where the heptode is not really suitable. Such an instance is the design of short-wave receivers, where some trouble with the heptode is sometimes experienced, especially when the incoming wavelengths are very short.

The new valve, known as the X41, consists of an indirectly-heated cathode, common to two sets of electrodes, forming a hexode and a triode. The hexode consists of four grids and an anode, and, starting from the cathode, we have the control grid, screen grid, mixer grid, screen grid and, finally, the anode. The two screen grids are connected together inside the valve and shield the mixer grid from the control grid and anode.

Advantages Over the Heptode.

The triode section is situated below the hexode in the valve envelope, and the triode grid is connected internally to the mixer grid so that oscillations generated by the triode modulate the hexode cathode stream.

The following advantages over the heptode are claimed: (1) Almost complete absence of interaction between the triode and hexode portions; (2) high mutual conductance in triode portion; and (3) high conversion gain due to the high impedance.

To explain these more fully, we can say that when a heptode is used at the higher frequencies, such as are experienced below 15 metres, trouble is experienced, due to the incomplete separation of the triode and tetrode portions. The input circuit thus influences the oscillator circuit, and above 20 megacycles the performance is generally very unsatisfactory. In the X41 this separation is much more complete, and successful operation is obtainable up to 40 megacycles and more.

A specimen of the X41, which is made by Marconi.

Again, with the heptode it is difficult to obtain a satisfactory high oscillator voltage above 15 to 20 megacycles, due to the poor slope of the triode section. Thus very tight coupling between the anode and grid coils is often used, and this produces squeggering and uneven oscillation. As the slope of the triode in the X41 is twice that of the heptode, very much better coil design can be used. In addition, the gain is better throughout and the high impedance exerts less damping on the tuned circuit connected to the anode.

Operating Details.

The X41 is a mains indirectly-heated valve of normal heater voltage, and takes a current of 1·2 amps. Maximum anode voltage is 250, with screen voltage of 80 and maximum oscillator anode potential of 120 volts.

HIGH-POWER "NARROWCASTING"

By Alan Hunter

AFTER two years of more or less tentative effort from the Daventry short-wave transmitter, the Empire Service is about to "grow up." Orders have been given by the B.B.C. for two high-power transmitters, each capable of a maximum aerial radiation of something like 100 kilowatts. The two existing 20-kilowatt transmitters will be merged into one more powerful unit.

Coincident with these developments the B.B.C. plans to put up a whole new series of 350-ft. aerials. These will enable the B.B.C. to provide the Empire with a vastly better service than is now possible.

Concentrated Beams are Best.

Underlying its plans is the conception of "narrowcasting," which is a form of transmission midway between omni-directional radiation or broadcasting and the type of transmission usually referred to as the "beam."

Experience has convinced the B.B.C. that it is better to serve a relatively small area of the Empire really well than to attempt to cover a much wider area and risk all round inferior reception. This is a perfectly genuine reason for the adoption of higher masts for the aerials and for pumping into them a higher power than at present. At the same time it would be fatuous to deny that the B.B.C.'s hand has to some extent been forced by the rivalry of foreign short-wave broadcasters—notably of France and Germany.

Many listeners in various parts of the Empire have reported much stronger signals from Poste Colonial and the Zeesen stations than from the appropriate Daventry station. The reason has been quite clear. Whereas the B.B.C.'s signals have been directed over a wide angle of radiation, the competing foreigners have often been sending on much more concentrated beams.

Wide Area to Cover.

No other broadcasting organisation in the world has such a wide area to cover as Daventry, simply because it has the whole world to cover. Individual transmissions from foreign stations will often tend to be more clearly heard in odd corners of the Empire than Daventry, because such foreigners will probably be concentrating on a particular area.

The B.B.C. aims at a general raising of the standard of its Empire Service over as great a part of the globe as possible. The higher-powered stations and the new aerial arrays will certainly help the Corporation to achieve this object.

For the past two years the B.B.C. has transmitted over 9,000 hours of programmes to the Empire from its two Daventry stations. During this necessarily tentative period a great deal has been learned about short-wave propagation, more especially as to how aerial design affects it.

The B.B.C. is improving the standard of its Empire Service by increasing the power of the transmitters and erecting new aerial systems. Within a few months this service should be the most powerful in the world and fully capable of competing with its most formidable rivals abroad.

Practically every possible wavelength has been tried out. Six distinct wavebands were available for the experiments, these being roughly on 14, 17, 20, 25, 32 and 50 metres. No less than 17 different aerials were provided for transmission, at first all erected on short masts of only 80 ft. total height.

Six of these aerials were omni-directional, one for each of the distinct wavebands already mentioned. The rest were designed for more or less directional transmission—or narrowcasting, as the B.B.C. is beginning to call it.

At first sight it seems an enormous number of aerials for just two stations. Yet actually they were all needed. To understand why, one must recall something of the very nature of Empire transmission, which resolves itself into world-wide transmission via short waves.

As is now widely known, above the surface of this troubled globe lie at least two distinct canopies or regions of ionisation. One hovers at about a height of 60 miles above the earth, this being called the Kennelly-Heaviside layer. The other is about 180 miles high, and is called the Appleton layer after its recent discoverer.

Reflection from Appleton Layer.

Short waves go round the world in a series of "hops." First they are shot off at all angles from the transmitting aerial, passing upwards through the lower layer, which apparently does not hinder them as it does medium and long waves. When they get to the upper layer they are bent backwards, travelling down through the lower layer to earth. The earth deflects them upwards again, and so the process continues. As the waves pass through the lower layer they lose strength, so that there is a limit to the number of times they can "hop" and still retain their value.

It so happens that the loss of signal strength increases with wavelength, from which it might be assumed that the best transmissions would be those on the shortest possible wavelengths. It is not so easy as that. Below a certain critical limit of wavelength the upper layer ceases to bend the waves back, and simply lets them pass into space—lost to the world for ever.

Naturally a compromise has to be found. And that compromise depends, as engineers have discovered, on many factors, chief of which are the time of day, the season of the year and the particular phase of the well-known 11-year sunspot cycle.

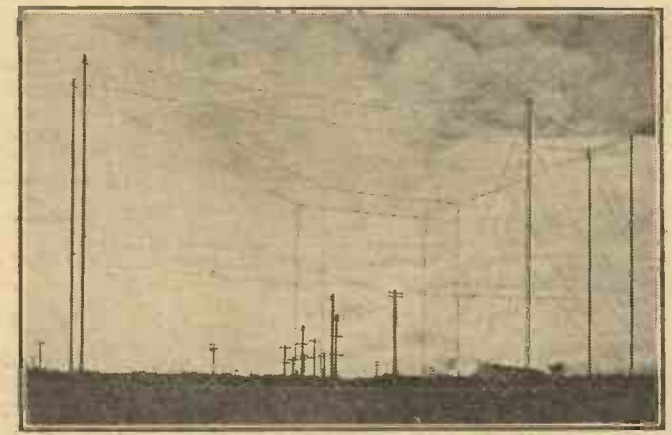
Always Transmitting.

From this elementary explanation it is obvious that when the B.B.C. attempts to cover the world with short-wave signals, it must indulge in a vast number of compromises. As it will aim at giving each main sector of the Empire a programme at a convenient local evening period, it will have to transmit practically the clock round, and for that reason alone a large number of different wavelengths will be needed for maximum results.

If you stand at Daventry and visualise your position with respect to the rest of the Empire scattered over the rest of the globe, it seems obvious that omni-directional transmission is the only possible way out. On reflection it becomes clear that all parts of the Empire will not want to listen at the same time, because their local times differ so much from one another. This is fortunate in a way, because there

(*Continued on page* 388.)

THE AUSTRALIAN GROUP

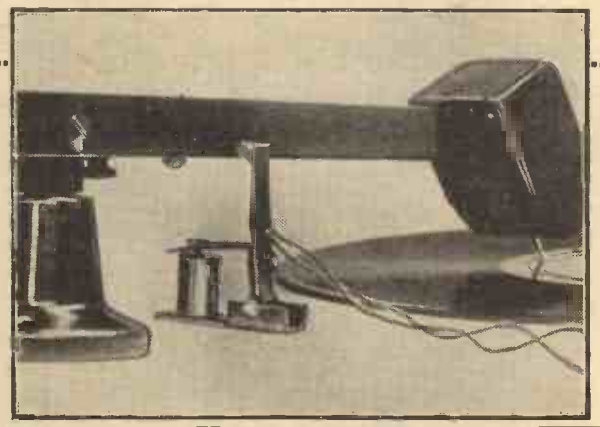


The original Australian aerial array at the Empire broadcasting station at Daventry, utilising a symmetrical arrangement of the aerial and reflector which allows them to be reversed.

MAKING AN AUTOMATIC GRAMOPHONE-MOTOR STOP

An ingenious device that is self-adjusting.

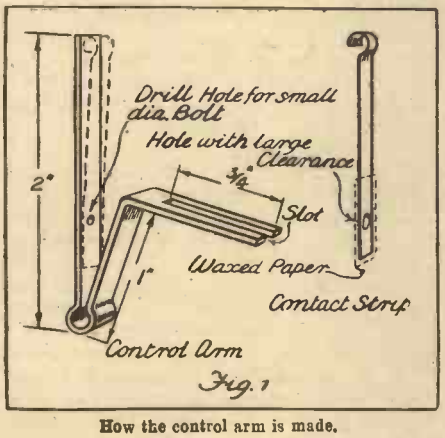
Designed and described by
J. ATTREE



THE STOP IN POSITION.

HERE are some details of a simple automatic stop-switch which has the advantage that it does not have to be adjusted for the size of record. No matter where the run-off groove of the disc ends the switch will function, variations in the makes of records being immaterial to the action of the switch.

The device is electrically operated and depends on the inertia of oil for its action. It is made in two parts, the control and the stop, and once the initial adjustments are made will act automatically at the end of any record.



How the control arm is made.

The control arm is made from a strip of stiff brass, bent, and slotted at one end as Fig. 1. The contact strip is of light spring brass. When cut and shaped, the bottom part of the contact strip is wrapped in waxed paper and pushed into the V of the arm so that the bolt-holes coincide, the bolt is pushed through, piercing the insulation but not touching the contact strip, and the nut tightened up.

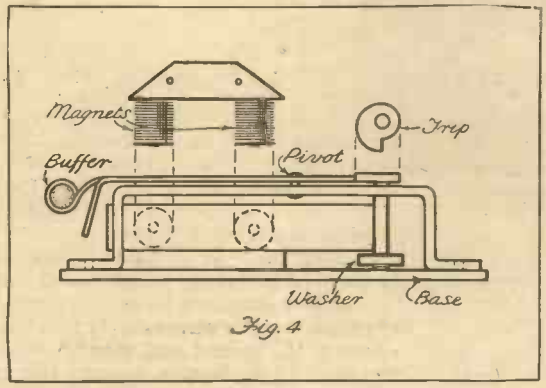
The oil container is of brass or copper tube, approximately $\frac{3}{8}$ in. diameter (Fig. 2). The plunger is a piece of lead, filed to an easy sliding fit inside the tube, with a stiff wire inserted. A strip of tin $\frac{1}{4}$ in. wide is drilled and slipped on to the wire for soldering to the top of the tube to keep the plunger centred, then a small disc is soldered to the top of the wire to engage the slotted arm.

The base is of stiff brass, and shaped as Fig. 3. The tube is soldered on (making sure it is leak-proof) and notches filed into the bent-up part to accommodate the contact arm axle. Contact arm must have free movement on its axle which is soldered in place.

Several working parts compose the stop.

READY FOR FITTING

The electro-magnetic brake assembled for use.

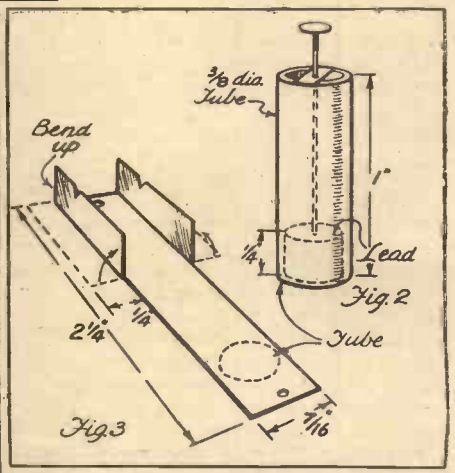


The magnets are mounted as shown in this diagram.

The magnet consists of five layers of insulated wire (28 or 30 s.w.g.) wound over a soft-iron core. Short lengths cut from a 3-in. wire nail will do for the core, making a riveted joint of the face plates. Insulate bobbin with waxed paper or tape before winding, to prevent possibility of leaks.

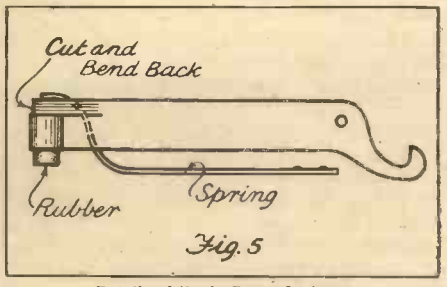
The armature is a thin strip of iron soldered at one end to a brass pillar which forms its axis. A piece of paper should be stuck on the armature face to prevent it adhering to the magnets when released. A short length of thin brass strip is arranged to form a very light spring to return the armature to its off position.

The bracket carrying the buffer and trigger is of brass shaped as Fig. 4, in which the shape of the trigger trip will also be seen. The buffer arm is brass, cut as Fig. 5. One end of the arm is cut where marked, the front section being bent to encircle the rubber buffer, while the back piece is bent down to engage the spring. If desired, the trigger may be wider, as in the photo, and a piece bent up to form a convenient handle. This spring is a short length taken from an old clock and after being twisted is riveted at the farther end to the base-plate, which is of stout metal.



The oil controlled plunger and the mounting plate.

To assemble these parts, first the buffer arm should be fixed on the bracket, then drill a hole in the base-plate to take the armature pillar. Insert pillar (with washer) and put bracket in place. After seeing that pillar is upright and has free movement, the holes for riveting the bracket should



Details of the buffer and trigger.

(Continued on page 390.)

ON THE SHORT WAVES

FIVE METRES AGAIN.

Some notes on the present position of five-metre work and the progress which has been made.

By W. L. S.

"P. W." has never been behind the times where 5-metre work is concerned. In 1933, when our Crystal Palace tests aroused more comment and activity than any other ultra-short-wave work previously attempted, we were instrumental in creating a large circle of 5-metre listeners who were prepared to support any other tests.

Since then, 5-metre "stunts" have followed one another with considerable regularity, but the "P.W." staff formed the opinion that spectacular record-breaking, although fully justified in 1933, was not the line on which to proceed for future work.

Question of Reliability.

After all, it is nice to know that you can cover 150 or 200 miles if you take your transmitter to a favourable location; but what concerns the average man is (a) how far he can transmit from his ordinary home station, or (b) how many transmissions he will be able to get on an ordinary receiver constructed and operated at home.

Accordingly we have settled down to the development of really reliable apparatus for short-distance, hundred per cent contacts, and we have not been making any particular song about the progress we have made.

Last year, it will be remembered, on one occasion station G 6 Q B was operated, being taken, for the particular test, to the station of G 2 C X, situated on the top of a hill at Sanderstead, Surrey. Signals were received at distances up to 40 miles, in all cases from ordinary fixed stations working from their home locations.

Improved Efficiency.

This year, just to see what progress had been made, the experiment was repeated, and the results, though in some ways disappointing (chiefly owing to the lack of active stations on the air), were, none the less, interesting.

Improvement in the efficiency of both transmitters and receivers has resulted, not in the achievement of contacts over longer distances, but rather in contacts with stations situated in valleys, in thickly populated and badly screened districts, and in greater reliability all round.

I must pause here to give credit where credit is due, i.e. in South London and North Kent, where the amateurs are really actively co-operating with each other in ultra-short-wave work. Every night, from 11 p.m. onwards, no matter how badly you are situated, you ought to be able to hear eight or nine transmissions.

G 6 Q B, this year, used a modified type of super-regenerative receiver, and a lower-powered transmitter than was employed last year. In spite of this low power, signals were reported as "R 8" or "R 9" by nearly every station worked. Owing to the complete lack of co-operation from North London, most of the contacts were limited to 15 miles or less, but all were hundred per cent reliable, and all but one were effected with "duplex" telephony.

In 1933, during the Crystal Palace tests, no "duplex" contacts were made. "Duplex," of course, implies the ability to hear the other man's transmissions, even though your own transmitter is working within a few feet of the receiver, and is usually possible in all cases except those in which the two stations are very close to one another in frequency.

TAKING THE STATION WITH THEM

G 6 Q B (standing) and G 2 C X (in car) during some five-metre tests last summer. Portable transmitters have become very popular this year, and have been greatly improved.

The chief change that has taken place this year is the extensive use of small tuned receiving aerials in place of long outside wires. From my own station I can receive better signals from most amateurs with a four-foot wire tightly coupled to the receiver than with a good 70-foot outside aerial.

Most of the transmitters use an aerial of the di-pole type, and for this reason many of them are very strongly polarised, either in the horizontal or vertical plane. Many a station using a horizontal di-pole cannot be heard when my four-foot receiving aerial is vertical, even though he may be R 9, or "R 9 9" when it is horizontal.

Those who work mainly on the transmitters are beginning to discover that low power with very full modulation provides results that are just as good as those obtained with higher powers and poor modulation. As the power-input is increased—in itself a simple matter—the difficulty in modulating it fully becomes considerably greater; hence the popularity of transmitters using 5 watts or less.

"Long-Line" Transmissions.

Another development, mainly due, in this country, to the pioneer work of G 2 A W of Bromley, is the use of the "long-line" transmitter, using neither coils nor condensers, but Lecher wires—in other words, "straight-line inductances"! Such transmitters are extraordinarily stable and also more efficient than the conventional type using a tuned coil.

Incidentally, I have been asked to explain the use of Lecher wires for measuring ultra-short waves, and I hope to do this very shortly. Readers who are keen on getting their receivers down to 2½ metres will be very puzzled to know when they have got there, unless they use the Lecher-wire method of measurement.

I had hoped to be able to give details, on this page, of some nation-wide 5-metre tests that are being carried out during June. At the time of writing they are not to hand.

New Theory Wanted.

Meanwhile, my advice to short-wave enthusiasts is to build themselves an ultra-short-wave receiver, which is the simplest thing imaginable and costs practically nothing. There will be plenty to amuse them by the time this summer is over, unless they live in really out-of-the-way parts of the country.

Recent tests among ourselves have established the fact that Central London is by no means a "dud" receiving area for ultra-short waves. And yet some of the South London stations are transmitting from very low-lying districts.

It's time the "quasi-optical" business was dropped in favour of another theory. Personally, I shouldn't be at all surprised to find that 5-metre waves simply follow the contour of the ground until they become so attenuated as to become non-existent.

ON THE SHORT WAVES—*Page 2*

WHAT READERS ARE SAYING

FIRST comes a letter from Nigeria, from which I must quote a few words. J. G. C. says: "I suppose your notes are big stuff from the point of the listener in England, but for me, who can only listen to short waves, they are disappointing. You all talk about listening on headphones with two or three valves, when a party of us out here heard the Royal Wedding, 'Queen Mary' launch and other outstanding broadcasts on the speaker, with a dud commercial set in the hands of a novice.

Big Set is Coming.

"Why don't you and Kelsey, instead of fiddling around with funny little adaptors and 'B.C.L.' Twos, let us have a really first-class 'big' set? When you can design something good with a 2-wave coil, radiogram switching and A.V.C., you will have served a really useful purpose to overseas listeners."

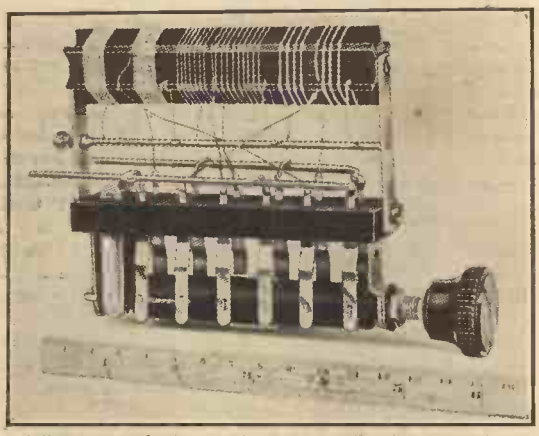
Thanks, J. G. C.! I'm afraid, as usual, that the overseas listeners *have* been having a thin time of it. Of course, at home here we take it for granted that anyone with a biggish receiver will hear all that's going on the speaker. What home readers seem to want is headphone reception of all those funny little stations that nobody's ever heard before.

But I *have* a big set on the way (yes, really big!), and I hope you will be pleased when it comes along.

C. B. (Liverpool) seems to have been unlucky. He got nothing on my single-valver but a howl like a soul in agony, so he built a two, and that won't even oscillate! Goodness knows, C. B.—obviously you've left a "nought" out somewhere in your calculations. There's no earthly reason why you shouldn't get the results with the single-valver that others have been getting for years.

Your query about coil sizes, I imagine, was answered in last week's article on the subject.

NEW S.W. COIL UNIT



A three-range short-wave change-over coil unit covering from 6-60 metres in three steps. Tuned with a ·0001 mfd. condenser the ranges are 6-18, 14-32, and 26-60 metres. It is made by Mervyn Sound & Television Co., Ltd.

C. G. (Jersey) takes the opposite view to the Nigerian reader who opened the ball this week. He says these notes are all very well for the old hand, but sheer Greek to the novice.

He complains that I just say "increase the G.B." or "reduce the H.T." without saying how much or why! Really, C. G., I have to assume that the short-wave reader knows a little about ordinary radio principles before he takes to short-wave work.

G. W. G. (Ipswich) backs up my rude remarks on tidiness, and gives some examples of things that *his* acquaintances do. One of them is to add more smoothing to a mains unit, jamming the extra choke up against the detector tuning-coils in the receiver. Queer tastes, some fellows have! He also suggests that I should discourage the use of "junk-stall" slow-motion dials (so-called), which, he says, must account for more failures than even I suspect.

Interference on 31 m.

Yes, G. W. G., I've met some funny ones in my time, too. I'd get on better with a plain dial than with some of the queer contraptions that people struggle with.

Regarding your other remark—about the awful interference on the 31-metre band—I've already covered that! Nothing but a single-signal superhet will do anything with it on Sunday afternoons nowadays. **W. L. S.**

TELEVISION JOTTINGS

Some Random Notes on Recent Developments.

A NEW type of neon lamp for low-definition television work has recently been introduced by the Mervyn Sound & Vision Co., Ltd. Known as the "Meraco" lamp, and selling at 7s. 6d., it is claimed to be particularly suitable for the battery-set user.

One electrode is of fine wire gauze, and the other is a flat plate of suitable size for use with a 16-in. disc receiver. It strikes at about 180 volts, and should be run at 190 volts, at which voltage it takes about 15 m.a. It should be used in series with a 1,000-ohm resistance, and it appears to require a very small signal-input to modulate it fully.

A standard bayonet-cap is fitted.

The French Transmissions.

It is difficult to reconcile the adoption of 60 lines for the new French television broadcasts with the French P.M.G.'s statement that the programmes will be "better and more up-to-date than anything in Great Britain or Germany."

Surely our friends in France do not regard our present 30-line transmissions as our idea of a national television service? They are purely experimental transmissions of somewhat limited value, and their entertainment value (apart from the thrill of novelty experienced by newcomers to the game) is pretty low!

Germany is ahead of us in that a high-definition transmission is already in existence. We have one all ready and waiting for the word "Go!", but the starter has been a little chary of dropping his flag.

America Follows.

So the U.S.A. is going to get busy too! The R.C.A. has agreed to spend a million dollars or so on television, and the ultimate result will be a regular transmission (on ultra-short waves, of course) from the Empire State Building, giving a real programme-service for New York.

Experimental work has been going on over there for a long time, but they, like ourselves, do not seem to want to "rush" things overmuch.

The Use of 2½ Metres.

Developments at present seem to suggest that wavelengths well below 5 metres will ultimately be used for television. One can obtain a band-width of 2 megacycles on 2½ metres with the same ease (or difficulty!) with which one can obtain 1 megacycle at 5 metres. Furthermore, it seems that the range of a 2½-metre transmitter is no less than that of a 5-metre, and might conceivably be greater!

Given a receiving valve that will oscillate down there without going blue in the face, the whole thing's easy (or is it!).

More Rumours.

Recent ultra-short wave tests from the roof of a London building have given rise to the amazing rumour that a chain of television stations is being erected throughout London. This has reached me from two or three different sources, and, needless to say, has been "scotched" in each case. But still it flies round.

I suppose my new vertical di-pole on the chimney-stack (for 5-metre amateur work) will start a new story on its rounds.

The Adaptor Position.

Lots of people seem to have the idea that they will be able to receive high-definition television by the connection of some kind of magical ultra-short-wave adaptor to an ordinary broadcast receiver. I should have thought "P.W." had been sufficiently emphatic upon this point, but the confusion has probably arisen from the statement that such an arrangement would be all right for sound reception.

I am all in favour, however, of building the complete television receiver in sections; and it would seem an excellent plan to build the real ultra-short-wave part as one unit, the I.F. amplifier as another, and so on. The ultra-short-wave circuits could then be tested out on amateur transmissions, and fed into an L.F. stage with a pair of headphones, just to make sure that they are doing their stuff.

There's no feeling quite so helpless as that which one gets when a big set remains obstinately silent and one doesn't know which section of it has revolted. That's why I'm all in favour of building everything in workable units.

I.F. Transformers Soon Ready.

I am told that I.F. transformers, specially designed for 240-line television, will be on the market within a week or so. That being the case (and I hope it's true), if you have an ultra-short-wave detector circuit all ready, you are very near the completion of the receiver! **L. H. T.**

This Committee Business

By Lord Strabolgi

Our contributor, who, as Lt.-Commander Kenworthy, sat for many years in the House of Commons, has a wide and varied knowledge of parliamentary procedure. In this article he gives his views on Committees in general, and refers to the P.M.G.'s Advisory Committee on Broadcasting.

AS all those interested in broadcasting know, a committee has been appointed to "sit" on the future of broadcasting in Great Britain. The Royal Charter of the B.B.C. expires on December 31st, 1936.

The Cabinet has no broadcasting policy to offer to Parliament, so they have fallen back on the time-honoured device of a committee. Its chairman is Lord Ullswater, formerly Mr. Lowther, M.P., Speaker of the House of Commons. He has spent a great deal of his later life in presiding over Committees, from the Grand Committee of Parliament downwards.

The Committee system is a British invention. In no other country in the world does this device flourish to such an extent. Except in commercial affairs, where things have to be done or the companies or persons concerned go out of business, very little is ever accomplished in this country without a committee, and not always then.

The alleged rulers of the country who advise the King in all important matters are members of a committee known as the Cabinet. The Committee system is so developed in the House of Commons that there are no less than two hundred Committee rooms of various kinds. The system spreads down to the village cricket club and the Parish Council.

Shelving the Problem.

If we went to war with somebody tomorrow, the first thing that would happen would be the appointment of a multitude of new committees, despite the fact that committees abound already in the Admiralty, War Office, and Air Ministry.

If the parish pump of Little Puddlecombe requires a new coat of paint, a committee is set up to decide on the colour of the paint and who is to do the job. Whenever the Government of the day is in a quandary, they appoint a committee. If they are being pressed on some awkward question, they appoint a kind of super-committee known as a Royal Commission.

If the chairman and other members are well chosen, that is the end of the matter for five years. If, to the horror of those concerned, the Royal Commission reports within a reasonable period, a Select Committee is then set up to examine its report. If, in the passage of time, the whole matter isn't either forgotten, or has solved itself, then the final refinement of this system is resorted to by the appointment of an Inter-Departmental Committee. This latter consists always of high panjandrums appointed from the permanent civil service staff of the various Departments of State. They can be relied upon to delay, bemuse and bemuddle any awkward problem indefinitely.

However, there are committees—and committees. No doubt Lord Ullswater's Committee will do its work competently, examine lots of witnesses, visit Broadcasting House two or three times, and will finally agree on a report, well prepared by the trained civil servant who will be its secretary, and I dare wager that the solution will be that the B.B.C. is to go on as it is at present.

A Foregone Conclusion.

Indeed, this decision could have been arrived at without all this intricate inquiry if the Postmaster-General, or the Prime Minister, or whoever it is who has to take the decision, could make up his mind on what is, after all, not a very difficult question. For we are not going to resort to the American system of "selling the air" to advertisers; nor are we going to see the B.B.C. taken over holus-bolus by the Post Office authorities; and therefore the present semi-official Corporation is the best compromise. Everyone knows beforehand that the present system of controlling broadcasting, now well tried, and, on the whole, successful, will be adhered to.

LORD ULLSWATER

Lord Ullswater, Chairman of the Committee appointed by the Postmaster-General to enquire into the future of Broadcasting in Great Britain.

In the case of a brand-new problem of a highly technical nature, a committee is often genuinely useful. Such a case was that of television. The committee appointed under Lord Selsdon to examine into television, and report, did its work well. The information provided for the Government and the public was valuable, and the indications are that, contrary to the usual practice, action will follow on the lines of the committee's recommendations.

The Government that would certainly take the prize for appointing committees was the late Labour Government, under the leadership of the present Prime Minister before the National Government was formed. That Government was in a minority in the House of Commons, and was in a precarious situation from the very beginning. It managed to survive for two years by referring every difficulty to one or other of the recognised forms of committee for inquiry.

Five Years—Still Sitting!

Altogether it appointed no less than one hundred and eighteen of these! Some of them are still sitting, and one of them reported the other day on town planning. It was appointed in 1930. As it so happened this particular committee produced its report at just the right moment, for one of its recommendations was to put a stop to the present ribbon building which is spoiling the new roads, disfiguring the countryside, and generally proving itself a nuisance. And the ribbon building is to be stopped by a Bill which will presently become an Act of Parliament, sufficient time being given for the jerry-builders and landowners to stake out as many claims as possible in the interval so that they can claim compensation.

But Mr. Ramsay MacDonald's second Labour Government appointed one committee too many. In the spring of 1931 black clouds of financial and economic depression began to gather across the political skies. There was a demand in Parliament for economies, a storm was brewing, and the usual subterfuge was resorted to. Another committee was appointed.

But the other Parties, who actually had a majority in Parliament under their

(*Continued on page* 388.)

"SELF-TUNED" RECEIVERS

A new departure in superhet radio set design described in a particularly clear manner

By J. C. JEVONS

ALTHOUGH the tuning of a modern set is invariably made as simple as possible, there is still room to exercise a certain amount of skill in getting the best out of it. In a sense this also applies to the simple crystal receiver—where careful coaxing will often produce results not otherwise to be obtained—although in the latter case there are no tone and volume controls to be considered. But as the power or reach of a set is increased, and with it the necessity for keeping selectivity always at razor-edge—so as to shut out unwanted signals—it becomes more and more difficult to meet the demand for simplicity in tuning at all costs.

An A.V.C. Effect.

In the first place the designer will gang the various tuning condensers on to a single control shaft, and then apply A.V.C. to counteract fading. Next, the further refinement of Q.A.V.C. is required to shut out the fierce background of noise as the set is tuned from one station to another.

At this point another complication arises. Automatic volume control—when efficient—is a distinct blessing from the point of view of keeping the loudspeaker at constant strength, but at the same time it can be a bit of a curse when it comes to the question of tuning. The very fact that A.V.C. "holds" the signal-strength steady, for some distance on each side of the true resonance point, prevents the listener from being able to tell, by ear, when the set is accurately on tune.

One remedy, of course, is to use a visual indicator and to tune the set by sight instead of by ear, as is already standard practice in most up-to-date models. But another plan is at present under development which solves the problem in an even simpler manner, because it is practically automatic in action.

The underlying idea is to so arrange matters that once the main tuning condenser has been adjusted to within a certain distance—say, 5 kilocycles—on either side of the required station, the set itself then takes charge of the rest of the operation and automatically "seeks" and finds the exact point of resonance.

To do this a "control" current is brought unto play directly the first or rough setting of the main tuning condenser sets the circuits within striking distance of the required station. If the original "rough" adjustment is, say, slightly above the correct frequency, the control current is caused to flow in one direction, whilst if the original setting is slightly below the right tuning point the control current flows in the opposite direction. In either case the current is utilised to shift the tuning up or down until it is dead accurate.

One way in which such a control current may be produced is shown in Fig. 1, which is only intended to illustrate the basic principle involved. It will be seen that the aerial circuit is coupled to two separate input circuits B and C, each feeding one of a pair of push-pull rectifiers V, V_1.

Suppose that it is intended to receive a particular station, say, on a wavelength of 300 metres or 1,000 kilocycles, and that one of the input circuits B is tuned a little above this frequency whilst the second circuit C is tuned the same amount below. Now assume that the main tuning condenser A is first roughly set to the required station, say within 5 cycles of it either way, and is then left alone.

HOW THE SCHEME OPERATES

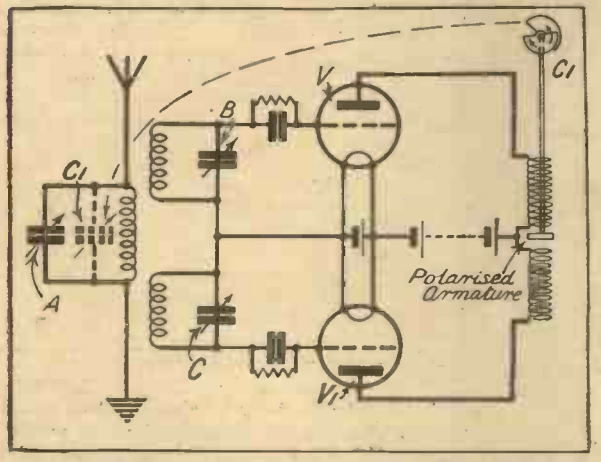


Fig. 1. A theoretical conception of the new device as applied to the aerial circuit tuning of a set. In practice the use is limited to the intermediate frequencies of a superhet, as is explained in the article.

Obtaining Movement.

If the rough setting is 5 cycles higher than that required, the aerial will transfer more energy to the circuit B than it will to the circuit C. This will cause the rectifier valve V to pass more current than the valve V_1. The resultant current is then passed through the control coils of a polarised armature so that it turns the shaft of a condenser C_1 in one particular direction.

Should the original rough setting of the condenser A happen to be slightly lower than the required frequency, the second detector V_1 will pass more current than its opposite number V, the result being that the condenser C_1 is now rotated in the reverse direction.

Actually the condenser C_1 is inserted in shunt with the aerial condenser A, as shown in dotted lines, and it is moved automatically in the manner explained until the tuning of the aerial circuit lies exactly midway between the tuning of the condensers B and C. In this position it feeds precisely the same amount of energy to both input circuits, so that the "vernier" condenser C_1 then remains stationary, keeping the set dead in tune with the required station.

In an ordinary straight-circuit receiver this arrangement would obviously not be worth while, because it means that both the condensers B and C must be pre-set to each particular station one wants to receive.

A Practical Application.

But with a superhet receiver it immediately becomes quite a practical and useful proposition, because the automatic control can then be coupled up to one of the intermediate-frequency circuits, which are, of course, always kept at a constant frequency. This means that once the control circuits B and C have been pre-set, one a little above and the other a little below the intermediate frequency, they can "stay put" and will thereafter act automatically to bring the first or rough adjustment of the main tuning condenser accurately into tune.

"INTERMEDIATE" CONTROL

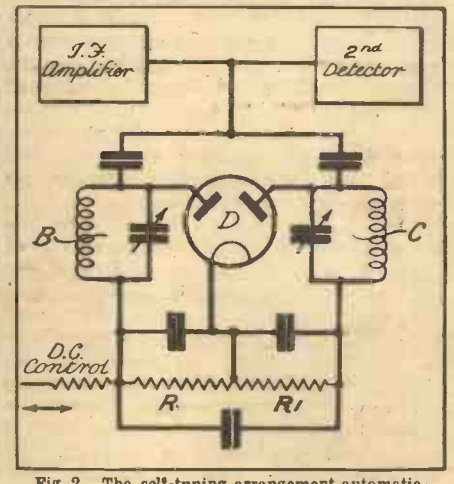


Fig. 2. The self-tuning arrangement automatically compensates for any mistuning, which naturally results in an incorrect intermediate frequency being supplied.

This is illustrated in Fig. 2, where the two parallel circuits B, C are shown capacity-coupled to the I.F. amplifier.

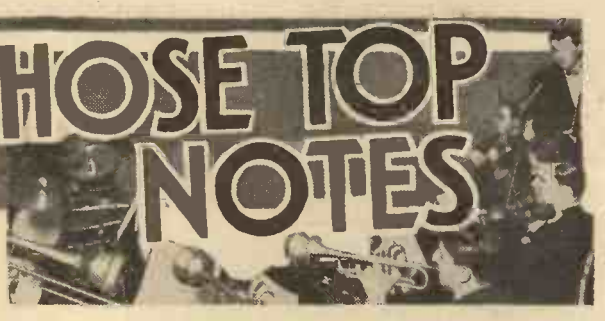
Should the first or rough setting of the main tuning control be such as to throw the I.F. frequency a little above its right value, the circuit B will feed more energy to the diode detector D than the circuit C, and the voltage drop across the load resistance R will be greater than that across the resistance R_1. This produces a "control" current which follows the potential gradient so created.

On the other hand, if the original tuning happens to be a little too low, the situation is reversed, and the D.C. control current will then flow in the opposite direction, as indicated by the double arrow.

Instead of making the control current operate a relay to rotate a correcting condenser in the way shown in Fig. 1, there are other and more delicate ways of using it.

Perhaps the simplest is to apply it to alter the grid bias on one of the preceding valves, so as to increase or decrease the damping effect of that valve on the tuned circuits. Or it can be passed through iron-cored tuning coils, so as to alter their effective inductance by saturation.

BRINGING OUT THOSE TOP NOTES



DETAILS OF AN INTERESTING LOUDSPEAKER PRINCIPLE.

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

NOT only are the *wives* of radio enthusiasts the slaves of fashion! Mr. Radio Enthusiast himself, in all his glory and pride, buys and uses a moving-coil loudspeaker because "five million listeners can't be wrong." Meanwhile, a most interesting and, in some ways, better type of loudspeaker languishes in obscurity.

Let us think for a moment how the moving-coil speaker works and what is wrong with it. The moving part that forces the air backwards and forwards, creating sound waves, is a cone. The driving force is applied at its apex, where the coil is attached; and the whole affair

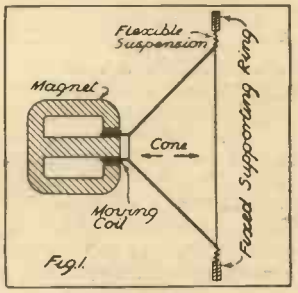


Fig. 1.

THE PISTON ACTION

The coil of a moving-coil speaker moves in and out along the axis of the cone, as shown by the arrows.

is suspended so that it is more or less free to move in and out along the axis of the cone (Fig. 1).

The coil carries the continually changing currents derived from the output of the receiver, and, as currents always do when they pass around a coil, they set up corresponding magnetic forces. The coil is suspended within the concentrated influence of a very powerful magnet, and it is the reactions of the changing magnetic forces on the surrounding steady magnetism that drive the coil to and fro.

The Effect of Weight.

When a very high note is played in the studio the coil tries to move backwards and forwards thousands of times a second in the endeavour to reproduce it. Now, the coil and cone together have a certain amount of weight, which it is fairly easy to make vibrate slowly; but at this high rate it has hardly started to move forward when it is pulled backwards, and so on.

Moreover, the driving force is applied at only one part of the cone, and by the time its remoter edges have started to move one way the apex is already on its way back again; so the resulting sound waves oppose one another and tend to cancel out. "A house divided against itself cannot stand."

It is only in reproducing the lowest musical notes that the cone of a moving-coil speaker can be persuaded to move as a whole. Any attempt to stiffen it up and so make it more rigid inevitably adds to the weight, and so defeats its object.

Of course, a moving-coil loudspeaker can, and does, reproduce high notes too, but owing to what has just been described it treats them very unequally—some are grossly exaggerated, while others are suppressed. Moreover, they are heard much more strongly in a line just in front of the cone than a little to the side.

You are probably all familiar with moving-coil reproduction that manages to be boomy and shrill at the same time. That is due to unequal treatment meted out to the musical scale.

Using a Condenser.

Comparatively few listeners—not even all experimenters—really realise that a condenser can be made to work as a loudspeaker—one that overcomes the difficulties just described.

When you apply a voltage between the terminals of a condenser the plates are attracted together. If a variable condenser were to be mounted on very delicate, frictionless bearings a large voltage would

GETTING MORE POWER

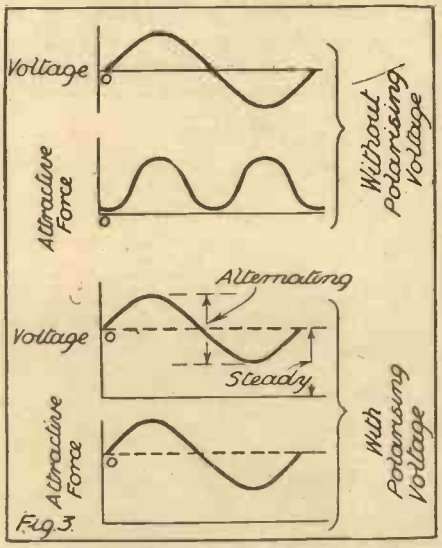


Fig. 3.

The use of a large, steady voltage (polarising voltage) greatly increases the efficiency of a condenser loudspeaker. For example, a bigger output is obtained for a given input.

cause it to swing into the maximum-capacity position. There are, in fact, voltmeters which work on precisely this principle and are obtainable commercially.

In the same way the metal foils in a fixed condenser tend to squeeze the paper or mica dielectric between them whenever the voltage is applied. In practice, though, there is no room allowed for motion if the manufacturer has attended properly to his business.

So no ordinary condensers, fixed or variable, start reproducing the programme on their own. But by suitably constructing a condenser it is possible to make a very excellent loudspeaker. Some of the early types needed absurdly high voltages to work them and were very inefficient; so most people who heard about them dismissed the whole idea as being impracticable.

That is a pity, for condenser (or electrostatic, as they are usually called) loudspeakers are a perfect revelation to listeners who have never heard how natural speech and music can sound when the high notes or frequencies haven't been cut or mutilated.

The difficulty in devising a practical condenser loudspeaker is that if two plates are very close together they are liable to touch and short circuit the whole thing. If, to avoid this, some solid insulating material is put in between free motion is interfered with.

Ingenious Construction.

On the other hand, unless the plates are extremely close together the driving force is too small to give a volume of sound comparable with that obtainable from moving-coil and other types. Further, even if two plates can be held very close together without solid material, the thin film of air between them acts in the same way as a pneumatic door-stop to check rapid movement.

All these difficulties have been ingeniously overcome. One plate is formed of a slightly curved sheet of aluminium, perforated with rows of small holes. The other plate is a very thin, almost transparent sheet of metal foil on the back of thin waxed paper.

This composite diaphragm of metal and insulation is corrugated in such a way that the troughs make contact with the aluminium sheet (paper side inwards) halfway between each row of perforations, while the crests stand back from them.

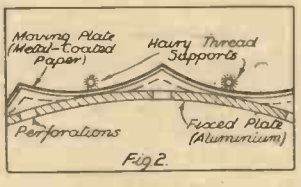


Fig. 2.

IN SECTION

A sectional diagram showing how the diaphragm of a condenser speaker is arranged.

Fig. 2 shows a greatly enlarged section of a small portion. The diaphragm normally lies as shown, and is kept from falling away from the fixed plate by the light contact of hairy threads running along the troughs.

When a voltage is applied between the fixed plate and the metal backing of the diaphragm the two are attracted, and the latter goes to occupy some such position as that shown dotted. You will see that it

(*Continued on next page.*)

HOW AN ELECTROSTATIC SPEAKER IS CONNECTED

moves with a sort of squeegee action, squeezing the air out through the holes. If the voltage is cut off the diaphragm flies back again and air is sucked in.

Obviously, if an alternating voltage is applied the air keeps on being drawn in and out, causing sound. There is one very important point to notice at this stage. The plates are *attracted*, whichever is made positive or negative. In one complete cycle of alternating voltage first one side is positive and then the other.

So the attraction takes place twice, and

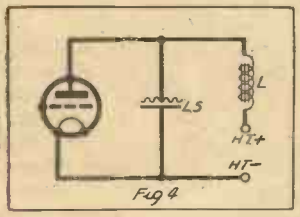


Fig 4

A SIMPLE METHOD

One of the simplest schemes for connecting a condenser loudspeaker.

two cycles of air waves are produced. The result, from an acoustic point of view, is to raise everything an octave in pitch—a horrible state of affairs.

This difficulty, too, can be overcome. If a large, steady voltage is applied to start with, so that the alternating voltage for producing the sound is never large enough to reverse the original direction, then only a single sound wave is produced for each voltage wave. Fig. 3 should be studied to make this clear.

The Practical Aspect.

What it doesn't make clear, but which is a very valuable extra advantage into the bargain, is that the steady voltage (*polarising* voltage, it is called technically) greatly increases the efficiency, so that a greater volume is obtained from a given number of milliwatts of power from the output valve.

Having assimilated the foregoing description of how a condenser loudspeaker works, it should not be very difficult to see

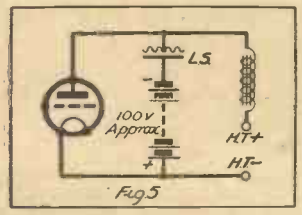


Fig 5

WITH EXTRA BATTERY

How an additional H.T. battery can be employed to boost up the voltage.

why it is that people who attempt to use it in the same way as other sorts are more than likely to be disappointed.

To start with, it is worked by *voltage*, not current, as are other types. True, being a condenser, an *alternating* voltage is bound to cause a certain amount of current to flow in and out of it, but that is a mere unfortunate accompanying effect. If, in order to get as much voltage as possible across the loudspeaker, a step-up output transformer is used this condenser current is too much of a load on the valve, and the result is rattling and distortion.

The correct ratio depends on the impedance of the valve and on the size of the speaker. Naturally, the larger the area of the speaker the greater its capacity. One standard size is 18 in. × 20 in., having a capacity of about 0·02 mfd. It is suitable for a one-to-one ratio transformer or output choke when a valve of about 1,500 ohms is used. A low-impedance valve aids quality at the expense of volume.

Secondly, a polarising voltage must be provided. This is quite easy. It exists ready for use in the form of the H.T. And, being a condenser, no current is drawn. So if the H.T. voltage is not high enough an old, partly run-down battery may be used to supplement it.

The Voltage Limits.

Fig. 4 is the simplest method of connecting. L may be either an output choke or transformer, and, if the latter can be used to run a moving-coil speaker at the same time, to supply the low notes. You see, low notes require a much larger movement to provide sufficient volume, and there is not enough unrestricted movement in the electrostatic loudspeaker to give full bass.

But the high notes are reproduced far more perfectly, because of the extreme lightness of the moving part and the fact that the driving force is applied all over its surface, so that all parts of it move simultaneously.

In a battery set there may not be quite enough polarising volts. The best results are had with 200–250, and 300 shouldn't be exceeded. But it *is* possible to do with about 150. Fig. 5 shows how to use an auxiliary battery to boost the H.T. a bit.

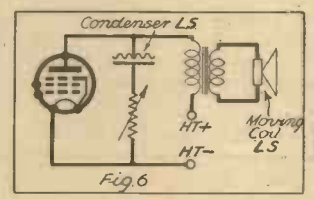


Fig 6

PENTODE OUTPUT

In this case the condenser speaker is joined in a similar manner to a tone-correcting condenser.

ANOTHER SCHEME

This circuit shows a method of using a step-up or step-down transformer

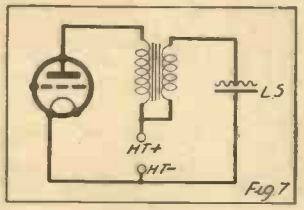


Fig 7

When the output valve is a pentode a good way of adding a condenser speaker is just to substitute it for the usual tone-correcting condenser (Fig. 6). Quite often there is a tone control at this point in the form of a variable resistance; if so it is still useful and should be left in position.

On the whole, though, a triode output valve is much to be preferred to a pentode, which, curiously enough, tends to cause the high notes to be lost in this type of speaker.

Still another circuit is shown in Fig. 7, which is the one to use if a step-up or step-down is wanted.

And, of course, you can't get the full benefit if the high notes are cut off in the receiver itself by filters, over-sharp-tuned circuits or excessive by-pass condensers.

THE LINK BETWEEN

Items of interest concerning happenings in the radio trade.

ONE of the highlights of the trade news this week concerns the birth of a new valve company. I have it on the best authority that a range of Ever Ready valves, to be marketed by the Ever Ready Radio Valve Co., Ltd., is shortly to be placed on the market, and that it is likely to include all the up-to-date types of battery and mains tubes.

Although, at the time of going to press, I have no characteristic data, the high standards of manufacture associated with the name of Ever Ready lead me to expect great things from this new valve organisation, and I look forward with interest to an official announcement on the subject.

In the meantime, my informant tells me that these new Ever Ready valves are being fitted to certain of the latest Pye receivers, which, to me, at any rate, is a most significant indication of their efficiency.

Learning About Radio.

My weekly post these days seems to touch upon practically every subject from killing weeds by wireless (no, *please* do not write and ask me for further details until you have seen my own garden paths, and then you will not want to!) to ways and means of hearing baby crying when the radio is on.

It is all very interesting, but the thing that surprises me most is the increasing number of newcomers who are thirsting for knowledge, and who ask me to put them on to a book that deals comprehensively with the subject of radio in beginner's language. Well, I can and do suggest certain books, although volumes that really answer to these requirements are in my opinion few and far between.

But I sometimes wonder if the text-book method is the best way of going about it. I suppose it depends upon to what extent the would-be student is interested. Anyway, arising out of these letters, it occurred to me that it might be time well spent to find out something about the correspondence courses which are now available, and I must confess, as a result of my investigation, that I am one hundred per cent in favour of them.

The radio courses offered by the International Correspondence Schools, for instance, are certainly first class.

I think it is an excellent institution, and I am full of praise for the thoroughness of its work. To those of you, therefore, who wish to become really well versed in radio matters, whether for your own amusement or with the object of taking up wireless as a career, I can offer no better advice than that you should obtain a prospectus for yourselves. The address is Kingsway, London, W.C.2.

Something Like a Dial!

There seems to be a lot of activity in the complete set world at the moment, and almost everywhere I go I hear of new and impending releases. And to think that there are still people who think that radio is seasonal!

At any rate, it is quite apparent that the set-makers have proved the contrary, and the old idea of saving up all the new models until show time has given way to the system of releasing instruments as they are developed. Well, that's something to be thankful for, even if only from the point of view of the potential buyer, who, hitherto, has been forced to wait until show time for the latest models.

One of the latest firms to spring into prominence with a new idea in sets—and in my humble estimation it is a really bright idea—is McMichael, and in the design of the Model 135 superhet de luxe, which this company has just released, there is a development that appeals to me tremendously.

Perhaps that is because I have an inherent dislike of skimpy dials. I do like something that can be read without a magnifying glass and in which the unhappy combination of a thick dial pointer and tiny station-names type does not give rise to the belief that you should, according to the evidence, be hearing about three stations at once!

Anyway, in this new McMichael design there is a dial that acted upon me like a dose of tonic. It is situated under a hinged lid, so that despite its enormous size it does not detract from the appearance of the finished instrument. But *what* a dial! If you hold the same views as I do on this matter, take my advice and pay a visit to your nearest McMichael dealer to see it for yourself.

G.T.K.

TELEVISION

THE NEED FOR WIDE FREQUENCY CHANNELS

An explanation of why high-definition television must employ the ultra-short waves.

By L. H. THOMAS

WE have covered, in this series, most of the points affecting the design of a television receiver, from the aerial to the second detector. All that remains is the time-base equipment and the various accessories that accompany the cathode-ray tube.

As these are hardly matters that the average home constructor is likely to experiment with (at least, until the time of the first transmission draws a trifle nearer) I want to begin to cover some of the fundamentals of television, both from the transmission and the reception point of view.

First of all, I should like to clear up a point that seems to have been worrying many readers, judging from letters that I have received. This concerns the frequent remarks that you see to the effect that there is "more space" on the ultra-short waves.

How Much Space?

Just how much space is there? And how long will it be before *that* space becomes overcrowded and sends us away to look for new acreage?

Fig. 1, on this page, may possibly help to reassure you. On the extreme right an ordinary thin line represents the width of the 1,100–2,000-metre broadcast band—the longest wavelengths that concern the ordinary radio enthusiast.

A little to the left is a very narrow band representing the medium-wave band—200–600 metres—in which are crammed all the broadcasting stations of Europe, with a 9-kc. separation.

The first "great wide open space" represents the short waves, between 10 and 100 metres, occupied by commercial services, Army, Navy and Air Force stations, and private experimental stations owned by amateurs.

The total width of the band is 27 megacycles, providing space altogether for 3,000 stations with a 9-kc. separation. At the lower edge is the narrow 10-metre amateur band, now allotted for the "sound" channels of amateur television stations. Just below that is their "vision" channel, of equal width.

Tremendous Frequency Range.

All the space from this point down to the amateur 5-metre band is available for television. This space (although it is described as the 5–10-metre band) is actually nearly as wide as the 10–100-metre band, as you will see from the diagram.

Just think of the amount of "meat" that you can find in the ordinary medium-wave broadcast band, and then compare its size with the new television band, and you will understand that the question of overcrowding doesn't arise just yet. Admittedly each television station will occupy a very wide slice, but then we have the normally limited range to consider. Probably one station in London and another in Birmingham could operate on the same wavelength without causing an interference area anywhere.

After that, reflect that the wavelength from 5 metres down to 2½ metres (60 to 120 megacycles) occupies a space of exactly the same width as the whole Fig. 1 diagram. Amateurs are already busy developing 2½ metres, and finding it good.

So much for the space question. Now to clear up the reasons for wanting all this space. With television in its present state of development, it is agreed that at least 240-line scanning is necessary if we are to have sufficient detail in our pictures to afford real programme-value on a wide range of subjects.

In other words, each picture transmitted must be "sliced" into 240 sections, which must be transmitted through the ether as a sequence and reassembled by the receiver.

Furthermore, to avoid flicker it is necessary that at least 25 pictures per second shall be transmitted. From this it follows that the number of horizontal "slices" of a picture going through the ether every second is 240 × 25=6,000. Each of these horizontal slices will be crammed full of variations in light-value, so that there may be as many as another 240 impulses in each one of them. Another multiplication sum brings up the total number of impulses per second to 1,440,000.

The highest modulation-frequency in ordinary speech and music, as transmitted by broadcasting stations, is in the region of 10,000 cycles, and should not really be higher than 9,000 under the present European agreement. There is, therefore, *comparative* peace in the European ether, with its stations all spaced 9,000 kc. apart.

Room for Three Stations.

From the above you will see that television stations must be placed not less than 1,500,000 cycles apart. Let's call it a spacing of 1½ megacycles. There's only room for three such stations in that band between 5 and 10 metres.

But, as I said before, we are saved by the limited range of the ultra-short waves, as there will probably be *very* few people in the country who could hear more than one station, even if ten were transmitting on the band.

By this time next year, no doubt, we shall all be thoroughly accustomed to television technique, and shall have settled down to the design of receivers with a "top limit" of 1½ or 2 million cycles instead of 10,000. Lack of "top," of course, in a television receiver results in fuzziness and absence of detail, which, after all, is very much akin to the effect of missing "top" in a broadcast receiver.

Picture Detail.

The thousands of listeners who simply do not know good quality when they hear it will be in very different case when television is tackled; you can't make yourself imagine detail in a *picture* when it's not there, whatever your ears may do for you in a musical picture.

As a direct result of this, it follows that a much higher standard of performance will be required from television receivers than is the case with sound broadcasting.

Television transmission is in an extraordinary state of advancement at present. We are apt to think about the difficulties of receiver design, but what about the engineers who have to build *transmitters* to handle the same range of frequencies?

Those of us who have seen demonstrations know that there isn't very much missing, and development continues apace.

HOW THE WAVEBANDS COMPARE

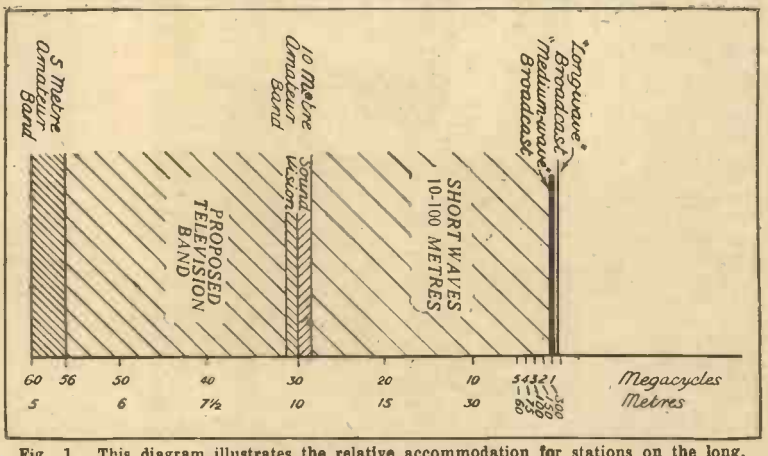

5 Metre Amateur Band
10 Metre Amateur Band
Sound Vision
PROPOSED TELEVISION BAND
SHORT WAVES 10-100 METRES
"Medium-wave" Broadcast
Long-wave Broadcast
60 56 50 40 30 20 10 5 4 3 2 1
5 6 7½ 10 15 30 Megacycles
Metres

Fig. 1. This diagram illustrates the relative accommodation for stations on the long, medium, short, and ultra-short waves.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return M S S. not accepted for publication. A stamped, addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

NEGATIVE BIAS ON A GRID THAT IS EARTHED.

S. R. T. (Sheffield).—"My set runs from the mains (A.C.), and after becoming interested in the ingenious method adopted for providing grid bias in mains sets I looked inside the set, to check up what I had learned. The resistance for automatic bias is there all right, with a condenser across it as described. But I got a surprise which I am still trying to fathom.

"I found that the last valve's grid is connected only to the secondary of the L.F. transformer; and the other side of the secondary is connected to *earth*, and to the resistance and condenser for bias.

"Since the *unbiased* grids of other valves are also connected to the *same* earthing point, I am absolutely stumped as to why the last valve's grid is biased negatively while the others are not.

"However the bias may be provided for the last valve, *what prevents it from reaching the other grids, to which that one is connected?* There is no doubt at all about the grids all being joined via the earthed baseboard, for I was so puzzled that I "clicked through" from the last valve's grid to the H.F.'s, and they are definitely joined.

"So why should one get bias and the other not? (The set is working perfectly, so I think there is no doubt but what the last valve has its proper negative bias on its grid.)

Two Methods of Obtaining Bias.

We think your difficulty has arisen from the fact that you are unconsciously supposing that a grid which is biased negatively is necessarily negative as compared with earth; and this is a wrong view, as a little further consideration will show.

When a valve has to be worked with a negative bias on its grid—say 6 volts—the essential condition is that the grid shall be 6 volts negative with respect to its filament (or cathode). It is not essential that the grid should be 6 volts negative with respect to earth.

It so happens that in almost all battery sets the filament (or cathode) is permanently connected to earth, so in making the grid negative to the filament (or cathode) it also becomes negative to earth. But this earth-grid potential difference is incidental; what is important is that there should be the 6 volts *difference between that valve's grid and cathode.*

The potential difference can be obtained in two ways. The cathode may be connected to earth and the bias voltage inserted between earth and the grid return (with positive to earth), or the grid return may go direct to earth and the bias voltage be inserted between earth and cathode (with negative to earth).

This latter is the method adopted in your set. Further examination will show that the unbiased valves have their grids and cathodes joined to earth. So there is no potential difference between their grids and cathodes, and these valves work without bias.

The last valve's cathode, however, is not connected to earth, like the grid, but is joined to a resistance, across which is developed a potential. Thus there is a potential difference existing between this valve's cathode and grid which has the effect of keeping its cathode positive with respect to its grid. This is the same thing as keeping its grid negative with respect to its cathode.

WHEN THE DIAL LIGHT BURNS OUT.

J. H. McD. (Fort William).—"When a set is working off the electric light mains and it is noticed that the dial-light has burnt out, should the set be kept switched off till a new one has been fitted? Or will it not hurt to run it without a dial-light temporarily?"

Ordinarily, the effect of the dial-light's current is negligible, so it does not hurt to run the set as usual in such circumstances.

THE SUMMER'S EFFECT ON LONG-DISTANCE RECEPTION.

P. H. (Edinburgh).—"I do not keep a reception log, like some of your readers, but my memory is a good one; and I am sure that there is not such a big drop in summer this year as there used to be, in so far as getting foreign programmes in Edinburgh is concerned.

"Compared with three or four years ago the number of foreigners received on a three-valve set is now quite three times as great as it was in the summer of, say, 1932. Is this just luck, or is it the better valves now used?"

There may be some luck concerned, and the improved valves of to-day would certainly have the effect of lessening the number of foreign programmes lost through summer conditions.

More important still, there is the question of the power used at the transmitting end. You must not lose sight of the fact that there has been a quiet revolution taking place in broadcasting in the past few years, and the power of foreign stations has increased enormously in country after country.

It is probably this factor that is making the most difference in summer-time reception to-day, as compared with that of a few years ago, and the improved receiving sets also tend to prevent the big fall-off that used to be so noticeable.

A GIANT SPEAKER

This looks rather like a searchlight, doesn't it? But it is actually a 500-watt Western Electric loud-speaker for outdoor public address work. It was used for the first time in connection with the International Yacht Races.

THE SIMPLEST CURE FOR A LOUD-SPEAKER RATTLE.

We are pleased to give space to the following letter from A. S. P., of Doncaster, because the fault which was spoiling his reception is one that may be troubling other readers, despite our frequent warnings as to how such a rattle may be avoided.

The letter is self-explanatory, so we give it without further comment.

"You will be glad to know that I have stopped the noise at last, thanks to the hint in your letter which stated, 'And do not forget that the cause of an intermittent loud-speaker rattle is sometimes overlooked because it is something quite *obvious*, instead of something which is difficult to find. We have in mind such possibilities as a cabinet with loose back or side, loose nuts, or loud-speaker-gauze that has come unstuck from the fret.'

"Remembering that I had fixed a small terminal strip inside the cabinet (to which I used to run another pair of L.S. leads), I examined this and found that one of the terminals was loose on the thread. As I am not using the terminals now I took them off altogether, and have not had a trace of the rattle since.

"This is the simplest cure I have ever heard of, but I might have gone on looking for it for weeks, as I was on the wrong tack altogether—suspecting the valves, speaker coil-rubbing, etc."

USING THE AERIAL WINDING FOR REACTION.

B. F. F. (Sowerby).—"In one of the 'Popular' sets, which was built by an acquaintance of mine, there was a method of wiring a K.T.F. screened coil (Colvern) so that the reaction was obtained from aerial winding.

"Can you give me the wiring to this (in numbers), as he got such good results I should like to try it?"

The aerial series condenser and the F1 vanes of the reaction differential condenser should be wired to the coil No. 3 terminal. Its No. 2 terminal goes to No. 6 terminal, to the differential's F2 vanes, to earth, moving vanes of tuning condenser, filament, etc., together with the screen itself.

The Nos. 4 and 5 terminals need no external connections. And finally the No. 1 terminal goes to the fixed vanes of the tuning condenser and to "grid"—i.e., in the case of a detector valve to one side of the grid condenser.

The differential condenser used had a maximum capacity of ·0003 mfd.

CHIEF CAUSES OF L.F. INSTABILITY.

A. N. (Pelaw).—"When a proper service engineer comes up against instability what faults does he look for first? It seems to be caused in so many ways that it would be necessary for him to try likely ones first, then the less likely, and so on, till he finds where the cause lies."

He first considers whether the set is being worked under the wrong conditions—the over-running of a mains unit, for instance, or the insufficient spacing of the loudspeaker leads from the aerial or earth

(*Continued on page* 388.)

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RADIOTORIAL QUESTIONS & ANSWERS

(*Continued from page* 386.)

wiring. If it is a battery-run set he checks that the battery is suitable and in good condition.

If there is a predisposing cause for instability, its removal will often render unnecessary any further smoothing or other corrective of instability.

If not, he will usually concentrate on the output stage, where the provision of choke-condenser filtering may be needed.

Should this stage be found well-filtered already the probability is that there is inadequate smoothing of the detector's H.T., so de-coupling, or further de-coupling, is indicated.

These are the principal causes, and it is only in unusual circumstances that further investigation will be required.

HIGH-POWER "NARROWCASTING"

(*Continued from page* 377.)

is no doubt that a semi-beam signal provides a much stronger reception for a given transmitting power than does an omni-directional or broadcast signal. At the moment the "narrowcasting" aerials at Daventry spread out for an angle of about 34 degrees on either side of the central transmission line, but an even better signal would be received, it seems, with the angle narrowed to 20 degrees.

Quite apart from the horizontal angle, which determines the area over which the signal from Daventry will be well received, the B.B.C. has paid a great deal of attention to the angle at which the signals are shot off the aerials.

Controlling the "Hops."

By suitable design of the aerial arrays it is quite possible to control the angle at which the transmitted signal hits the ionospheric layer, and thus to alter the number of "hops" between Daventry and the distant Empire receiving points. Concentration in the vertical plane means better reception in any given receiving point.

Once again, though, a compromise has to be found, because, of course, along any given line of transmission from Daventry there are many parts of the Empire at widely differing distances. Perth, West Australia, for instance, although on the same bearing as Bombay from Daventry, is twice as far away. Another point of no little importance is that for this type of low angle concentration much higher aerial masts are needed.

Higher Aerials Erected.

Since the Empire Service began two years ago the Daventry National transmitter has gone to Droitwich, so to speak, and the two available 500 ft. masts have been used for some decisive experiments. The fruit of these will be seen in the new 350-ft. masts that are to be erected. Already there are two of these masts in action, and their success justifies the B.B.C. in going ahead with the scrapping of the 80-ft. masts and the erection of a whole new series of the 350-ft. masts.

Although the bulk of the experimental work during the past two years has necessarily been concentrated on the aerial design of the Daventry transmitters, it has long been realised that the power ought to be higher. Only by increasing the power of transmission—beyond that possible with aerial concentration, that is—can the distant listener be expected to reduce the background noise to a reasonable level.

More Money for B.B.C.

Fading is, apparently, not nearly so great a bar to enjoyment of Empire signals as is the high level of background. This is due, of course, to the relatively weak field strength of the received signal, and an appreciable increase in transmission power will materially help to increase the ratio of signal to noise at the short-wave receiver.

All this development work is now in hand, and within a few months the B.B.C. should be able to boast of the most powerful short-wave service in the world, capable of competing with even the most formidable of its rivals abroad.

That is very much as it should be. The rather delicate question as to why the home listener should pay for a service destined entirely for his kinsmen over the seas is, perhaps, another story. It may well be that the Committee now sitting to decide the fate of the B.B.C.'s Charter at the end of 1936 will see in this high Imperialistic ideal of the B.B.C. a first-class reason for voting it a considerable increase in the share of the licence money.

A WALKING BROADCASTING STATION

A portable radio telephony station produced by the German Telefunken company. The sizes of the aerial and combined transmitter and receiver can be easily gauged from the photograph. The range of the station is about 12 miles.

THIS COMMITTEE BUSINESS

(*Continued from page* 381.)

Conservative and Liberal leaders, insisted on a say in nominating the members. The result was the famous May Committee, under the chairmanship of Sir George May.

It worked at what the Whitehall bureaucrats considered positively indecent haste, and produced a report by August of that year which blew up the Government, led to the formation of the present Ministry of All the Talents and a General Election, helped to drive us off the gold standard, and had many other results, important and unimportant.

A Remarkable Development.

The most remarkable development of the Committee system in recent years has been in connection with the Fighting Services, to which I have referred already. In the days when we won our reputation as a naval and military Power, admirals commanded our fleets and generals our armies, and that was the end of it. They gave their orders and these were carried out.

To-day, however, a new factor has appeared in the Air Force, and, of course, the use of radio. Warfare has become more complicated, and so have the preparations for it. The people with real knowledge of the subject, and no prejudice, believe that there should be a single Minister of Defence with supreme control over the Army, the Navy and the Air Force. But this would be far too simple a solution for the panjandrums and brass-hats and the bureaucrats who inhabit the great offices on either side of Whitehall.

Still, the difficulty of overlapping and what is known as lack of co-ordination between the activities of the three Fighting Forces remains. So an attempt is made to meet the difficulty by the appointment of a vast cluster of committees. They are what the bacteriologists would call a rich culture.

Fifty for Services.

Lord Hailsham, whose title is Minister of War, but whose real activity consists in presiding over various committees of civil servants and generals, explained this matter in a debate we had in the House of Lords recently. He said that fifty committees were in existence which dealt with all the questions common to the three fighting services, such as supplies of stores and munitions, tactics and strategy, the use of man power and all the rest of it. Over all meets the supreme Standing Committee of the Empire, the Committee of Imperial Defence, under the chairmanship of an overworked Prime Minister.

However, as I have said, the one activity of our national life where the committee system is not resorted to is the "simple" business of commerce and industry. The activities of agriculture, manufacturing, mining and shipping are carried on for the most part by people who understand their business.

If we adopted the committee system in business we might soon be without food, light, fuel, clothing, transport, and—perhaps worst of all—our newspapers!

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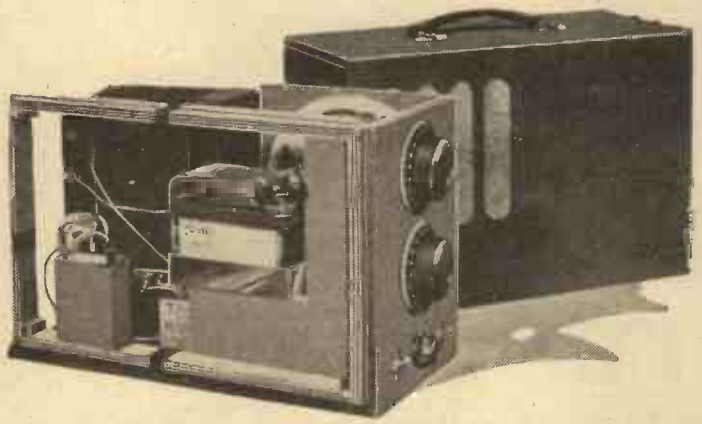

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By

JOHN SCOTT-TAGGART

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Edited by Jack Payne
Every Thursday At all Newsagents **3d.**

PREPARING FOR TELEVISION

(*Continued from page* 373.)

if any are used, should be of good make, good insulation, and of reasonable size. Tiny little terminals that may do perfectly well for ordinary radio purposes are, in my opinion, likely to be dangerous when used as connecting points for high-voltage circuits.

It is not usual to touch any connections in high-voltage work while the mains are on, but small terminals have, in many cases, a knack of slacking off at critical moments, with the result that the connections come adrift, and if that happens when a high-voltage circuit is in operation, all sorts of unpleasant things may happen.

Well-Insulated Terminals.

Thus it behoves one to use big, well-insulated and well-marked terminals, and here it is of interest to note that not only do Belling & Lee make really fine big terminals, with well-protected tops (type B), but that they are starting to supply these with suitable markings for television. Not all the marks I should like to see have so far been covered—in the television list, but, at any rate, a start has been made, and Belling & Lee are to be congratulated on their foresight.

On the cathode-ray side of television, as I said before, there has been more done than on any other side, as far as we can judge by appearances, but it is not safe to judge a book by its cover, and I believe that a tremendous amount of research has been carried out by firms interested in the supply of short-wave apparatus. Eddystone, Colvern, Burne-Jones, Polar, have all been hard at it devising intermediate transformers, special short-wave coils, air dielectric trimming condensers, tuning condensers, and so forth.

But, so far, very little has been made public, and so I cannot tell you about the things that are in store.

On the mechanical television side things seem to be in the hush-hush and uncertain state. Until we know exactly what transmissions are to be the order of the day when the new station starts, we cannot very well do much on the mechanical side.

A Mechanical System.

I can say, however, that B.T.S. are well advanced with a mechanical system of television which they will be putting out in kit form in due course. It is a mirror drum arrangement with sixty mirrors and a multiplying scheme, but more than that I must not say at the moment.

Incidentally, the same firm has not forgotten the claims of the cathode-ray method of reception and are also well advanced in the production of kits of parts for a complete cathode-ray time-base and exciter unit. In addition, a short-wave receiver for high definition television reception is on the stocks.

Reverting to the mechanical system of reception, B.T.S. have just sent me the first model of a new Kerr cell which they are going to put on the market for home constructors. It is a particularly robust piece of work, and should be very welcome. As in the case of the di-pole aerial mentioned earlier, no price has at the moment been fixed, but here again I understand it will be surprisingly low.

The Kerr cell is illustrated on one of the pages in this review, and the two Nicol prisms, for polarising and analysing the light, are made to fit on the two flat sides of the Kerr cell.

But with the exception of the parts mentioned I cannot give you much information regarding the progress made on the mechanical side of television where the high-definition system is concerned, and indeed it is obvious that the mechanical television designers have been even further handicapped by the official silence regarding the coming television broadcast system than have the workers on the more flexible cathode-ray method.

So we find that cathode-ray apparatus is being advertised, while television short-wave gear and mechanical television parts for high definition are not being noised abroad nearly so much.

Concerning the Radio Side.

Thus it is also inevitable that this article should be almost entirely concerned with cathode-ray television, but because this is so I do not want you to think that this is the only part of the science where investigation has been made. The cathode-ray side is certainly well developed, but when the time comes I think you will find that the radio side, at any rate, without which the rest would be useless, of course, has been just as well gone into, though the results have not been made public.

MAKING AN AUTOMATIC GRAMOPHONE-MOTOR STOP

(*Continued from page* 378.)

be made and the bracket fixed in position. Next the magnet should be fixed to the base in such a way as to allow the free end of the armature about an eighth of an inch latitude. Then the trip should be soldered to the top of the pillar, arranging it so that the buffer trips when the armature is almost touching the magnet. Finally the springs are put in place and it is ready for fixing to the gramophone motor board.

To instal, the oil container must first be about half-filled with light or medium lubricating oil. The control is fixed under the pick-up arm about one and a half or two inches from its pivot, arranging so that the tone arm touches the light spring contact when the needle is about a dozen grooves from the end of a record.

The Battery Connections.

A flexible wire is soldered to the spring contact, the other end of wire being taken to one side of a flash-lamp battery. The other side of the battery is connected to one end of magnet windings, the other end of these windings going (via flex) to the control upright. The flex here should be of the light variety, such as from an old phone cord.

The adjustment for trouble-free and certain working consists of bending the spring contact strip nearer to or farther from the main upright, so as to get the tension correct for the particular grade of oil being used.

SYNCHRONOUS MOTORS

Items of Interest to all Readers

By Dr. J. H. T. ROBERTS, F.Inst.P.

SEVERAL readers have told me of the good results they have had with the synchronous turntable which I mentioned in these Notes some little time back. The original turntable of this kind was the Simpson, but there are others now on the market.

The arrangement is an extremely neat one and really consists of a synchronous motor (of the Rayleigh wheel type) laid out so flat that it is practically contained within the turntable itself. The windings are on the stator, which is centrally fixed and has a number of teeth or poles around its edge.

The turntable itself forms, of course, the rotor and has a corresponding number of inturned poles which engage magnetically with the poles of the central stator. There is no commutator or anything of that kind, the alternating current (the device works only on A.C.) being fed straight into the windings of the stator.

The result is that the poles of the stator are subject to a magnetisation fluctuating in accordance with the frequency of the A.C. and the poles of the rotor, that is, the turntable, keep in step with the A.C. frequency. In order to start the turntable you simply give it a spin round with the finger and it immediately falls into step.

Constant Record Speed.

Apart from the fact that this device is of the utmost simplicity, both mechanically and electrically, it has the very great advantage that it runs at absolutely constant speed. Needless to say there is no speed regulator, because obviously the thing must run in step with the A.C., and cannot, therefore, be varied.

The number of teeth on the stator and rotor are arranged so that the turntable runs at the correct gramophone speed on a current of 50 cycles-per-second frequency. Therefore there is no need for you to check up the speed or to worry about speed regulators or anything else. You simply give the thing a flick with the finger and proceed to play the record. When ordering this you need to specify the voltage, that is, 100/110 or 200/250, and also the frequency.

Although the frequency in most parts of the country is 50 cycles per second, there are some parts in which different frequencies are used, and this naturally is very important. I should mention before leaving this matter that these turntables can be obtained from the well-known firm of Peto-Scott Limited, whose advertisements you so often see in "P.W."

Pick-up with Selective Receiver.

Talking about records, by the way, I don't know whether you have noticed that if you are using a pick-up in conjunction with a very selective receiver, there is a tendency for the higher register parts of the reproduction to be more emphasised. This is not accidental; the low-frequency and detector parts of the set have been definitely arranged to bring out the upper register, because the part of the radio circuit prior to the detector, being designed for very sharp tuning, probably uses bandpass tuning circuits or very highly efficient coils, and consequently cuts off the upper frequencies.

In other words, the low-frequency part of the set, when the set is being used as a radio receiver, has been designed to make up for the defects of the high-frequency part. When you are using a pick-up you are employing only the detector and low-frequency part of the circuit, and therefore you are using a part which has been designed to correct a fault which now does not exist—since the output from the pick-up has taken the place of the output from the high-frequency part of the radio circuit. When using a pick-up in a compensated circuit like this you will very probably get extra prominence in the upper notes.

Using Tone-Control.

In sets in which provision is already made for the pick-up, you will generally find that there is some kind of tone-control already provided, the object of this being, of course, to get over the difficulty just mentioned. Inasmuch as this involves an additional control knob, some people think that it is better done without, and in that case you can introduce a fixed tone compensator, adjusted once for all to counteract the effect mentioned.

For this purpose all you need is a pre-set condenser connected in parallel with the terminals of the pick-up; the maximum capacity of this condenser may be 0·0005 microfarad, and you can vary the actual capacity until you get the best effect. Sometimes this simple arrangement does not work very well, because the condenser reduces the strength of the output from the pick-up, and instead of the condenser you can use a choke in series with one of the leads of the pick-up.

Choke or Condenser?

A still better arrangement, instead of simply a choke, is to connect a pair of condensers, which can be both pre-set, or one fixed and one pre-set, and having a value of, say, 0·0005 microfarad each, in series with one another and connected across the ends of the above-mentioned choke, the mid-point of the condensers, that is the connection between one condenser and the other, being connected to the opposite terminal of the pick-up.

An H.F. Pentode Hint.

When using a high-frequency pentode valve it is important to put a bypass condenser between the cathode of the valve and the connection to the screening grid: if this condenser is omitted, the volume is apt

(Continued on next page.)

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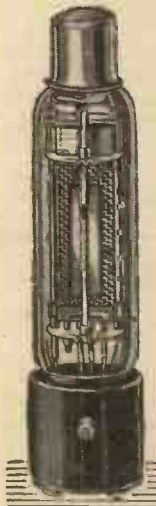

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SYNCHRONOUS MOTORS

(*Continued from previous page.*)

to be low. I have before me a letter from a reader telling me of some tests he made on this very point.

The set in question had a single stage of high-frequency amplification, for which the H.F. pentode was used, and at the first set-up no condenser was used between the screening-grid and cathode. The results were comparatively poor and eventually it occurred to him to put in this bypass condenser, which incidentally had a value of one microfarad (although it is more usual to use a somewhat smaller value than this). On doing this he found a very marked improvement in the volume.

Microphone Blast.

Have you noticed how sometimes you seem to get microphone "blast"? I noticed it the other night when Noel Coward's "Bitter Sweet" was broadcast. It seems as if the artist is speaking much too near the microphone.

I must say it doesn't happen often, and generally speaking the work of the control rooms at the B.B.C. is excellent. But it is impossible to prevent overloading if a very sudden excess of volume is passed into the microphone. It is more particularly noticeable on the "s" sounds and such-like high-pitched tones.

But don't get the idea that whenever your speaker "blasts" it is the fault of the transmission. In ninety-nine per cent of cases it is not the transmission at all, but your own receiver. Perhaps the loudspeaker is at fault, or much more likely, the H.F. voltage on the detector valve is too high, or there is trouble in one of the couplings or with the reaction.

It is a fairly safe bet that your set is at fault, and it is best to assume this and look it over for the trouble. The amount of blame you can put on the B.B.C. transmission is negligible.

THE B.B.C. HONOURS

Some Biographical Notes

READERS will already be familiar with the details of the Birthday Honours which have been conferred upon three members of the British Broadcasting Corporation, and which are referred to by Ariel on page 370. It is of added interest, however, to have a few biographical notes of the personalities concerned.

Noel Ashbridge—or Sir Noel, as we shall be calling him—is a true pioneer on the technical side of broadcasting. He obtained his solid background of knowledge at King's College, London, where he finished up with a B.Sc. Followed much practical experience in the B.T.H. Company and with the Lancashire Dynamo Co.

During the war his training led him inevitably into the Royal Signals, where as a wireless officer he served both in England and France. At the end of the war he went to Marconi's. For many years he was at the famous Writtle experimental station, which many early amateurs will remember for its pioneer broadcasting.

With him was P. P. Eckersley, who became Chief Engineer of the B.B.C., with Noel Ashbridge as Assistant Chief Engineer. That was away back in 1925. He continued in that position until his appointment as Chief Engineer when P. P. Eckersley left.

He has seen through the completion of the Regional Scheme of broadcasting, the inauguration of the Empire transmitters at Daventry, and more recently the building of Britain's giant voice—Droitwich National.

Under his calm and always modest control our broadcasting system has grown up to its present high standard of excellence. At the moment the Chief's time is fully occupied with the further development of Regional broadcasting, as well as with the improvement of the Empire Service from Daventry. Not to mention the beginning of the first real television service, with which he will naturally be intimately concerned.

All readers of "P.W." will congratulate the Chief on his honour, and will assuredly wish him the best of luck with his future undertakings.

Invaluable Service to Education.

Miss Mary Somerville is another member of the B.B.C. who, in a very different sphere of activity, has done fine pioneer work in an unassuming way. Her service to education by wireless is incalculable. Her O.B.E. honour signalises ten years of Schools broadcasting, and comes at a time when, by all accounts, we are on the eve of great developments in this particular branch of the B.B.C. system.

Miss Somerville was educated at Somerville College, Oxford, and lectured on "Mary Somerville, Mathematician and Physicist, and Pioneer of Higher Education for Women"—after whom the college was, of course, named.

She obtained an honours degree in the English language and literature, and during the war did a great deal of voluntary work in education. In 1925 she joined the B.B.C. as Assistant to the Director of Education, and in her care was left the special task of developing broadcasts to schools.

Miss Somerville is now Schools Talks Director, as well as the Secretary to the Central Council for Schools Broadcasting.

A Fitting Tribute.

Everyone knows Gerald Cock, the debonair "O.B." Director, for without him none of the exciting outside broadcasts of the past ten years would have been quite the same.

His honour comes as a fitting tribute to the enormous amount of work he has done to enlarge the canvas of the broadcast picture. His masterly "hook-up" with every conceivable kind of national event, culminating in the magnificent team work of the Jubilee relays, are too fresh in public memory for any emphasis to be needed now.

Mr. Cock has had a most exciting life—and he is still a young man. Mining, prospecting, ranch owner, explosive expert and consultant, not to mention a director of a film company; these are just a few of his many phases in a life spent in all parts of the world, including six years in Western America and adventures from Mexico to Alaska and South America.

In 1915 he landed at Liverpool to join in the war. Five weeks afterwards, having started with no knowledge at all of soldiering, he was a sapper in the front line near La Brasse, France.

Mr. Cock decided to "settle down" after the war, and in 1925 he joined the O.B. department—which certainly has not been much of a rest cure for him. It is a far cry these days to the period when he owned a ranch in Hollywood—on a site where the famous Sunset Boulevard now runs.

A. H.

THOSE SIMPLE PLAYS

(*Continued from page* 374.)

perhaps, because of the arresting personality of the speaker, Dr. Erwin Schroedinger. An Austrian by birth, so he told us, his mother tongue is German, he is 48 years old, and he claims English descent through his English grandmother. This is the man, the only foreigner included in the list of these speakers on "Freedom," who spoke to us mainly on British freedom. He said much that had already been said on the subject by previous speakers. This was not his fault, of course. He was speaking ninth. We mustn't forget that. That's one of the disadvantages of this system of serialised talks.

* * *

He spoke rather sarcastically, I thought, of the Englishman's slavery to unwritten laws. Life, he said, is more strongly tied up with these than any other. He also made interesting observations on fox-hunting. The English gentleman is shocked at the mere mention of a bull-fight. Ghastly cruelty to the animals and all that! A bull-fight isn't even allowed to be shown on the English screen, so great is our national abhorrence of the sport. Yet fox-hunting, where the cruelty is as great, if not greater, is traditionally the Englishman's sport, and so——

* * *

Dr. Schroedinger gave us a good deal of food for thought. Did he not specifically ask us to ponder over one of the questions he raised? This "Freedom" talk was distinctly above the average. It is good also to see ourselves as others see us, sometimes.

* * *

The appearance of famous musical comedy and light opera actors and actresses recently has done much to brighten the programmes. A few weeks ago there was an almost urgent need for them, as something seemed to have gone wrong with Music Hall and Variety. But Music Hall has recovered much of its lost prestige during the last few weeks. The famous musical comedy actresses in musical comedy, and not soloists in the studio only, do give an air of distinction to an evening's broadcasting. Witness the several appearances lately of Evelyn Laye.

* * *

The "Roosters" have a big reputation on the air. They will have to do considerably better than they did this week if they are to keep that reputation. It was a nondescript show and the jokes as old as time itself. This lapse may be accounted for by the fact that they were given only twenty minutes for their broadcast—an unusually short period for a concert-party.

A Good Partnership.

The Tommy Handley–Florence Oldham turn has lost none of its attraction with the passing of time, I liked them as much as I did when they used to broadcast in the Savoy Hill days.

* * *

Eights Week at Oxford began a new series of actuality programmes. It is always a matter of surprise to me that wandering microphones don't play a bigger part in our programmes. Many foreign programmes seem to find more space for them than we. On big occasions our mikes do get out and do their job exceedingly well. Their success on these occasions would seem to justify a more extensive use of them on occasions less great. Practically all news is presented from the studio. I thought the mobile unit was beginning a new era in news presentation, but this seems to have gone into comparative retirement, when actually its pioneer efforts, though far from perfect, should have encouraged the authorities to go all out with it.

C.B.

THE EXIDE SERVICE CONVENTION

NEARLY eight hundred people, delegates and guests, attended the recent three-day convention held by the Chloride Electrical Storage Co., Ltd., at Eastbourne.

The opening address was given by Mr. D. P. Dunne, managing director, who referred to the fact that the past year had been the most successful year of trading in the history of the company.

As usual the convention was a most enthusiastically successful affair, both in regard to the business proclivities and to the sport and pleasure that followed. Golf tournaments, steamer excursions, motor-coach tours, a banquet, cabaret, and so forth.

Among the entertainers performing at the cabaret was Giovanni, who brought the house down with his amazingly skilful sleight of hand. Stanelli was also there, with his famous "horn-chestra." Incidentally he is a first-class violinist, and has conducted the Bournemouth Symphony Orchestra and the Minneapolis Symphony Orchestra in U.S.A. He has been on the boards since the age of seven, when he appeared with Fritz Kreisler at a Royal Command performance at Dublin Castle.

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RADIO CRYSTALS. The famous "NEUTRON" Crystals, 1/- per tin; the oldest and best. Obtainable from: V. Zeitlin & Sons, Ltd., 144, Theobald's Road, London, W.C.1; Expert Radio Service, 266, High Street, Stratford, E.15; Real Radio Service, 61, Cannon Street, E.C.4; etc., etc.

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VAUXHALL.—T.C.C., 200 mfd., 10-volt, 3/-; Continental valveholders for Universal valves, with terminals, 9d.

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G.P.O. ENGINEERING DEPT. (No experience required.) Commencing £4 per week. Age 17-23. Excellent prospects. Free details of Entrance Exam. from **B.I.E.T.** (Dept. 568), 31, Oxford Street, W.1.

Read this powerful Long Complete Novel of Thrills and Action!

"THIRD DEGREE"

by Maurice B. Dix

Meet Gerry Lawrence and Tony Mattson, the most likeable hell-for-leather dare-devils who ever swaggered into fiction. In Gerry's own words, "They barge in where Scotland Yard fears to tread," and when a crooked financier robs Tony of a fortune, their "little punitive expedition" is like hell let loose! If you want a feast of red-hot action and breath-catching thrills, don't miss this long complete novel which appears in

The THRILLER

2d.

On Sale Saturday, June 15th, at all Newsagents.

SOUTHERN RADIO'S WIRELESS BARGAINS. Every Article Guaranteed New, Perfect, and Sent Post Paid.

TELSEN THREE-VALVE BATTERY SETS. Model S93 complete with 3 Mazda valves, in attractive Bakelite Cabinet, 30/- (List 75/-).

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COILS. Igranic Superhet 4-Coil Set (1 Osc.), 2 I.F. (with Pigtails) and 1 I.F. (Plain), 9/- per set (list 50/-). Varley Square Peak Coils with all Accessories, Type B.P.5, 2/3.

STOCKTAKING BARGAIN PARCELS. After our recent stocktaking, we gathered at our Head Office a very large number of odd lines from our various Branches. We are offering these in Parcel Lots as under:

5/- Parcel containing Components to the value of at least 20/-, including Condensers, Resistances, Coils, Wire, etc. 10 Different Ready Radio and Telsen Circuits are included with each parcel.

Branches at 271/275, High Road, Willesden Green; 46, Lisle Street, W.C.2. All Mail Orders to 323, Euston Road, London, N.W.1.

SOUTHERN RADIO, 323, Euston Road, London, N.W.1.
(Near Warren Street Tube.) 'Phone: Museum 6324.

BIRMINGHAM RADIOMART

SPECIALISTS IN SHORT-WAVE AND QUALITY COMPONENTS AT LOWEST PRICES.

Our stock is much too large to itemise here: From a soldering tag to a superhet, we can supply everything, and, what is more, you won't be "Caught"! Send 1½d. stamp for our latest **CATALOGUE.** No firm has larger stocks or is cheaper than

THE SQUARE DEALERS,

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19, John Bright Street, Birmingham.

LOUDSPEAKERS REPAIRED, 4/-. Blue Spot a Speciality. Transformers and Headphones, 4/-. Eliminators, Mains Transformers and Moving Coils quoted for. 24-Hour Service. Trade Discount. Clerkenwell 9069.—E. Mason, 44, East Road, London, N.1.

WOBURN RADIO OFFER FOLLOWING GOODS: ELECTRIC SOLDERING IRONS: 200/250-v. copper bit complete with flex and adaptor, 1/11, post 6d. Immediate delivery.

SHORT-WAVE CONDENSERS.—Air-spaced ·0001, ·00015, ·00016, ·0002, ·00025, 2/-; with slow-motion dial, 3/-. Popular iron-cored canned coils, dual-range, boxed, with instructions, 2/6. Dubilier and Erie resistances, all values, 6d. Truwind wire-wound colour-coded, all values to 50,000 ohms, 3½d. Western Electric Microphones, 2/3. Transformer for same ratio 100/1, 2/3. Rothermel Speakers, 7 in. cone, power and pentode transformer, new and boxed, listed 39/6, 17/6.

TRADE LIST NOW READY. Send stamp and trade letter heading.

WOBURN RADIO CO., 9, Sandland Street, W.C.1. Holborn 7289.

ALL goods advertised in last week's issue still available.
WARD, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

CASH ALLOWANCES made on your old wireless goods in part-exchange for any new receiver on easy terms. After deducting deposit we pay you balance of allowance in spot cash. Components and Peto-Scott kits supplied for cash or part-exchange. Highest allowances.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

WANTED FOR CASH. Second-hand Wireless Parts, Sets, etc. Exchanges. Bring or send.—University Radio, Ltd., 142, Drummond St., London, N.W.1. Nr. Euston Station (L.M.S.). Phone: Museum 3810.

BANKRUPT BARGAINS. List free. Quotes everything radio.—Butlin, 143b, Preston Road, Brighton.

ADVERTISEMENTS

As far as possible all advertisements appearing in "Popular Wireless" are subject to careful scrutiny before publication, but should any reader experience delay or difficulty in getting orders fulfilled, or should the goods supplied not be as advertised, information should be sent to the Advertisement Manager, "Popular Wireless," John Carpenter House, John Carpenter Street, London, E.C.4.

Special Midsummer Number

★

GOOD GARDENING is a magazine written by people with gardens of their own—gardens such as you possess. It tells of the soil and its constituents, of the things which some plants love and others loathe. It plans your garden for you, and teaches you how to improve it.

No gardening journal has ever before been able to illustrate its pages so beautifully or so lavishly as "GOOD GARDENING." Many varieties of blooms are shown in natural colours: the detail of many of the photographic illustrations is little short of marvellous.

GOOD GARDENING

SPECIAL MIDSUMMER NUMBER 6d.

Now on Sale at all Newsagents and Bookstalls

Here are some of the Contents of the Special Midsummer Number:

ENGLAND'S LOVELIEST ROSES.

A Beautiful Full-Colour Supplement.

THE SUMMER GLORY OF THE HERBACEOUS BORDER, by LADY MARTINEAU.

A WATERSIDE GARDEN, by ELEANOR SINCLAIR ROHDE.

THE GARDENS OF CANADA.

THE RIGHT WAY WITH PAEONIES, by MARION CRAN.

A GARDEN BY THE AVON, continuing MURIEL MARSTON'S serial story.

CAPTAIN KINGDON WARD'S further adventures in search of the Blue Poppy.

Printed in Great Britain and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: John Carpenter House, John Carpenter Street, London, E.C.4. Registered for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd.

Saturday, June 15th, 1935. S.S.

POPULAR WIRELESS, June 22nd, 1935.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE NEW TELEVISION SERVICE

(SEE PAGE 408)

Popular Wireless

AND TELEVISION TIMES

ON THE SHORT WAVES
★ ★
BARRY KENT CALLING
★ ★
ROUND THE RECORDS

EVERY WEDNESDAY PRICE 3D

No. 681.
Vol. XXVII.
June 22nd, 1935.

Our Special

SET BUYERS' OPPORTUNITY Number

DC/AC SUPERHET WITH TRUE 'H.M.V. TONE & PERFORMANCE' FOR 11½ GNS.

"...but this is the part that interests me..."

As a technical man, you are naturally more concerned with what a set is than with what the advertisements say it can do. Because of this, we invite you to examine the detailed specification of the new "His Master's Voice" Universal DC/AC Superhet. A copy will be sent you on request. Read it, and you will know what to recommend when your non-technical friends ask you which is the best DC/AC set they can buy.

'HIS MASTER'S VOICE'

UNIVERSAL ELECTRIC (DC/AC) SUPERHET FOUR..MODEL 340

"His Master's Voice," The Gramophone Company Ltd., 108H Clerkenwell Road, London, E.C.1

POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR: N. F. EDWARDS. TECHNICAL EDITOR: G. V. DOWDING, Associate I.E.E.

FROM THE AIR
RADIO ADVERTS.
ROME'S POWER
AN INNOVATION

RADIO NOTES & NEWS

THE SHOW
MOONSHINE
WHAT NEXT?
DR. RADIO

"Five Hours Back."

ALTHOUGH it is not ordinarily a part of my job to comment upon the B.B.C.'s choice of programme items, I feel I must hand them a congratulatory paragraph on the late feature "Five Hours Back." These relays from America were handled in first-class style, and although they came over at an awkward hour, they will be sorely missed.

Uncle Sam is one of those fellows who improves on acquaintance, and "Five Hours Back" was an excellent way of getting to know him. So hasten the day, say I, when we get our "Five Hours" back.

The Licence Race.

SINCE I first called attention to the possibility of Germany overtaking Britain and becoming Europe's greatest licence-holder, the final figures for a complete year have been published. From these it is found that Britain's steady annual licence rise amounted to 806,810, while Germany gained 1,090,314 in 1934.

The German figures include 427,464 free licences, as against Britain's 41,442 on which no fee is paid; for Britain gives free listening only to the blind, whereas Germany includes unemployed and others when handing out exemptions.

The big factors accounting for the German increase are Government encouragement and the standardised receiver known as the People's Set. In Britain radio grows naturally, with just a mild tonic now and then in the form of a Post Office detector van.

Scientific Heights.

THE great American balloon ascent into the stratosphere may have taken place when you read these words, for as I write the news is that an early ascent is hoped for. Last year's attempt, you may remember, provided a remarkable thrill for U.S. listeners. They heard the dramatic news of how the balloon got out of control, and thousands waited beside the loudspeakers all over the country until the later news of safe landing came through.

For this year's attempt the main transmitter has a power of eight watts. Below the gondola two self-contained transmitters will oscillate, the respective wavelengths being 5·36 metres and 2·68 metres. These two are for scientific measurements only, to find out what happens to radio waves above the clouds.

Big Clean-up.

LISTENERS to the Continent are aware that some of the radio advertisers are not above shouting, on umpteen kilowatts, about your more personal needs.

ON OTHER PAGES

Aces of the Ether - -	Page 395
Barry Kent Calling - -	Page 404
"You Can't Fool The Mike"	Page 406
The New Television Service	Page 408

They not only describe their patent medicines, but they enlarge on the symptoms you have, how to apply the ointment, and all that kind of thing.

Down Mexico way, where thoroughness is occasionally overdone, this class of advertising was particularised so fully and frequently that the old school chaps could stand it no longer. They have drawn up a masterly proclamation, in the best of taste, excluding the discussion of depilatories, deodorants, and other advertising of the nature not considered acceptable as topics in really nice society.

Crystals for Distance.

AMONG my correspondence on the above subject is a letter from G. H. M., of Dorking, Surrey; who tells me that he—like the man who claims "4,250 miles on a crystal"—was once a wireless operator in the Mercantile Marine.

G. H. M. has received Eiffel Tower's time signals up to 2,000 miles on a 31a Balanced Crystal Receiver, but never reached 4,250 miles.

And here's an interesting admission from an ex-professional wireless man about short waves. He says "I have recently renewed an interest in short waves, and find I can still read Morse up to 30 words a minute after a lapse of ten years.

"I must thank 'P.W.'," he continues, "for the Kelsey Adaptor, which has made it possible for me to recapture the thrills of space."

Italy's Latest.

ROMAN noses have recently been poking into this question of alternative programmes—so ably introduced into a forgetful world by P. P. Eckersley—and it has been decided that the Eternal City should have simultaneous entertainment provided on two wavelengths.

The idea is to erect a 120-kilowatt station on or near one of the Seven Hills and give a continuous two-wave service.

The existing Rome station's 50 kilowatts will be increased to 100—good news for British aerials, for even on the present power Rome is a station that commands our admiration.

The new Rome will not be built in a day, of course, but all the plans are out, and Mussolini's middle name is Hustle.

Royal Thanks.

THE etiquette that surrounds a Princess is not easily altered, so all the more honour to Princess Ingrid for her radio innovation recently.

So many well-wishers wrote congratulating her on her marriage that she decided that

(Continued on next page.)

AN APPRECIATIVE AUDIENCE

Men from the warships recently moored off Southend paid a visit to the Ekco works and were greatly interested in the highly efficient manufacturing processes employed. This photograph shows a group of Chief Petty Officers watching the wiring-up process. Note the electric soldering-irons.

A NEW HIGH-POWER LONG-WAVE BROADCASTER

printed acknowledgments were too formal and quite inadequate. So the senders were asked to listen in while she gave them royal thanks—a truly modern idea, with the ancient virtue of directness.

The Things They Say.

LEFT-HANDED compliments are so frequent in everyday conversation that it is remarkable that more of them are not heard over the air. A correspondent who has been collecting microphone errors tells me that at one station a Woman's Hour speaker, who gave advice on clothes to feminine listeners, rather put her foot in it with one of her correspondents.

That lady had written in about an appropriate fur to wear, and she must have been surprised when, in reply, the loudspeaker advised her: "*You* should never wear anything but skunk, if possible. It would be *most* suitable!"

We Shall See.

WHILE the Radio Exhibition at Olympia seems but a vague possibility in your mind, it is just a mass of knobbly facts and difficulties to the organisers and such chaps who have been fixing up the details to delight you.

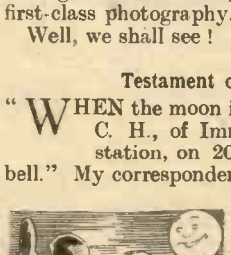
I hear that the B.B.C. will put the show on the air again, as last year, and Aug. 14th, 17th, and 24th are the dates spoken of for this.

"Television sets at Olympia?" did you ask? Not this year, but I have heard that demonstrations of the art may be staged that will make the past displays look like badly drawn pen-and-ink sketches seen through a beer bottle, as compared with first-class photography.

Well, we shall see!

Testament of Youth.

"WHEN the moon is at the full," writes C. H., of Immingham, "I get a station, on 200 metres, ringing a bell." My correspondent is 14 years of age, and being of a logical turn of mind he continues: "How do you account for that?"



My dear young sir, there is no accounting for anything when the moon is at the full. In a few years' time, you will notice, at that season, that not only do the distant stations then thump in on a crystal set, but other phenomena occur. For instance, strolling out with an ordinary Y.L., you will find she has, under that full moon, unexpectedly become a goddess, with stars for eyes. (At least, I *hope* you will find it thus, for the thrills of wireless are as nothing at all compared with the thrill of witnessing such a phenomenon. See Shakespeare & Co. re this.)

A New Long-Waver.

HEARING that the new "Radio-Romania" was due for testing on long waves, I have inclined mine ear to the 1,000/2,000-metre waveband more than usual of late. But, so far, without success.

This new station is erected at Brasov, out Bucharest way, and apart from the Moscow giant on 1,724 metres, it is as powerful as any broadcaster in Europe; in fact only Droitwich and Luxembourg can equal the new Radio-Romania's 150 kilowatts.

It will be interesting to hear how this newcomer gets over to the aerials of Britain, for his predecessor, on 1,875 metres, stood no chance at all with Kootwijk sitting on the same wavelength.

(This week's Awkward Question: What the heck does Romania want with all those kilowatts?)

BROADCASTING BREVITIES

Greta Keller, who has been called the Marlene Dietrich of the air, may be remembered by the very earliest listeners when she sang from Savoy Hill. Some years ago she returned to America, where she became one of the first of the "crooners." On June 26th she will be heard once more "on the air" in Britain, when she will feature various popular numbers in a show of her own, and on June 27th she will be heard in "Music Hall."

* * *

The Western Children's Hour programme on June 24th will be presented as if it were a bill in a cinema. It will include a topical news reel and travelogue, songs from Silly Symphonies, stage turns and a complete picture. It will conclude with trailers, giving excerpts of the best forthcoming programmes for the following month.

* * *

The monthly feature programme, "At the Langleys," including chiefly topical material, will be broadcast in the Midland programme on June 26th. There is a seaside entertainment from North Wales resorts the same evening.

* * *

Newcastle's annual "Race Week" will be the subject of special Northern programmes on June 26th. In the afternoon R. C. Lyle will broadcast a running commentary on the Northumberland Plate race—"the Pitmen's Derby," as it is called—and in the evening a recital of Tyneside songs by Archie Armstrong, the well-known Newcastle baritone, will be followed by an impressionist sound picture relayed from the great fair on the Town Moor.

High Goings-On.

THE listeners of Moscow recently had their first experience of a falling commentary, carried out by a parachutist during a descent at the central aero club of Moscow. They loved it.

The parachutist was a cool customer, with a clear voice, a short-wave transmitter strapped across his shoulders, and lashings of nerve. He announced "I now crawl out on the wing. I pull the cord. I fall—oooooooh!

"I am held up. I see the ground. I swing near it. I am down."

It was not a long commentary, nor a flowery one. But the Muscovites enjoyed it immensely, and the fast-falling adventurer is now a fast-rising favourite.

I wish I could have heard it, it would have given me a thrill.

Mystery of Science.

AN astrological gentleman has sent me a circular letter about what he calls the Mystery of Science.

It starts with an account of "The Discovery of Electrical Amber," and works down through the ages via Galvani and Mesmer to Volta and Marconi.

Dramatically ending upon the mystery note, it asks "AFTER THE WIRELESS—COMES WHAT?"

A reminder about the second instalment is my answer to *that* mystery. Next, please.

Those in Peril . . . .

MY references not long ago to the new medical service by radio for seafarers has brought me a dignified protest from a Morecambe reader. He wants to know why I did not mention the similar British service which has been available for twelve years?

Answer (given reluctantly!) if ever I knew of it, I forgot!

My correspondent says that any ship can call up a P.O. wireless station and have a message describing symptoms, etc., telephoned to the nearest hospital; the doctor's replies and other messages are sent for the bare cost per word, no charge being made for the medical advice.

I knew those operators at the P.O. stations were good senders, but I now salute them as Good Samaritans.

Perhaps I ought to mention that my previous note referred to the International Centre of Medical Radio-Communication.

War on Interference.

"WHY is there no law against people installing electrical machinery which interferes with neighbours' wireless all the time it is working?" asks an Ealing sufferer.

That, my dear chap, is one of life's greatest mysteries.

We Britons have wonderfully-worded laws about buying packets of fags over counters after 10 p.m.; we have remarkable licensing laws, surprising betting laws, irrepressible mother-in-laws, and many other constitutional cough-drops that amaze the other nations. But a law against radio interference? No, sir, Mr. Speaker can't be bothered about Mr. Loudspeaker.

ARIEL.

Aces of the Ether

This Season's Outstanding Sets

FIRST-CLASS radio reception for the million. That is what is offered by the sets of 1935. Or, at least, by the better productions of British wireless factories. There has been a great deal said about the wonderful progress which has been made in set design and production during the past few years, but it is as well to remember that the highest levels of the industry are not reached by every factory.

"Here to-day and gone to-morrow," applies just as forcibly to a proportion of the industry as ever it did. Unceasing research and continued enterprise are essential if a firm is to hold its own.

Keen Price Competition.

Keen competition has forced prices down, and it is this which has resulted in so many falling by the wayside. Not only because they were unable to produce receivers at competitive prices, but because they were unable to include all the wonderful developments and refinements at those prices, together with reliability.

It is very necessary to look askance at any make of set which does not bear the name of a maker having a reputation for reliable apparatus, and this is a fact which the public has learnt to its cost.

It will be unnecessary to mention the name, for no doubt most readers of "P.W." know it, but there was one firm which occupied a position at the very top of the market only a couple of years ago, and which has since gone into liquidation simply because its most widely popularised set failed to give reliable service.

Reliability Essential.

Of the thousands sold, at least fifty per cent were returned within a few months owing to faults which had developed in them. However good a receiver may look in appearance, and however good its performance and its ease of handling, its name will become anathema among the listening public if it fails in regard to reliability.

The whole fabric of broadcasting rests upon that one quality above all others. The transmitters of the B.B.C. are examples of the high degree of service which can be achieved with soundly designed and constructed radio apparatus.

No doubt thousands of would-be buyers of new receivers have set out on their mission lightheartedly only to return empty-handed, tired, and confused by the scores of different makes and models that are to be seen in the shops and stores.

How is the average listener to choose between so many? Should he ignore all the differences seen and unseen, pay no attention to conflicting claims and chance his luck by taking the first instrument that catches his eye or which is pushed under his nose by a zealous salesman?

It is because of the difficulties and dangers which tend to beset the unguarded listener in this respect that we have prepared these special articles on the subject of set selection and purchase.

Besides general information concerning the subject and a really helpful article on hire purchase, we have prepared test reports on a group of selected sets that can be regarded as representative of the finest products of the British radio industry and which constitute the best value for money that is being offered to-day.

Therefore, readers can regard our special number as a definite guide as to what to buy and what not to buy, and they will be doing their listener friends a service if they recommend them all to secure copies of this issue. They will all want to buy new sets some day!

A JOURNALIST CHOOSES MARCONIPHONE

BEVERLEY NICHOLS, well-known author and playwright, is a keen critic of radio programmes. He is here seen with his Marconiphone Model "264."

It is essential that they should be. Imagine the situation during a world broadcast of the King's speech if the B.B.C. kept breaking down!

A B.B.C. transmitter is an outfit which serves millions; a domestic radio outfit serves only three or four, but to those three or four listeners immunity from breakdowns is just as important, and the result is the same to them if there is a breakdown in their receiver as if there were a breakdown in the transmitter.

But the transmitters break down very infrequently indeed, though they are vastly more complex and handle great power, so the onus of uninterrupted broadcasting largely rests upon the receiver.

Service After Sales.

In order to provide against purchasers of their sets being rendered set-less for long periods, some firms have established elaborate "service after sales" organisations. This is a fine thing, but even more important is that the set itself should be one which gives trouble-free service and seldom, if ever, needs to be "serviced."

The ideal service is given by that kind of set which, once carefully installed, never requires any attention whatever, but goes on working satisfactorily for years.

Of course, even with the very best of makes it is impossible to provide guarantees against troubles occurring through careless and rough mishandling, though it is surprising how badly some of the 1935 radios can be handled before they will give way under the unfair stress.

Also, it must be admitted that minor troubles are occasioned in instances in the most worthy apparatus, but seldom are these found in the set itself, they more often occur in the accessories, and are correspondingly easy to rectify.

"Plain Commonsense."

No manufacturer desirous of creating large sales for his sets fails to ignore the supreme importance of service. It is plain commonsense. Obviously, it is soon going to become common knowledge that "X.Y.Z." Radio are untrustworthy if fifty per cent of their sets "pack up." Radio dealers will refuse to handle them for they don't want their customers staggering back with their purchases a few days after buying them.

But, as has been indicated, reliability is not a quality to be achieved by mere rule of thumb methods. In fact those firms who are able to manufacture really

ACES OF THE ETHER

This Season's Outstanding Sets

reliable sets possess that something which some others less fortunate have not got.

And it is up to the individual buyer of sets, in his own interests, to make sure that he purchases the wares of a firm of that calibre. (Each of those firms whose sets are described in this special number of "P.W." can be placed in that category.)

The idea still seems to be current that a radio set should have a "nice tone" in the sense of being able to give its own coloration to the speech or music it reproduces.

But a radio set is not a musical instrument. Its job is to reproduce the broadcast sounds with a minimum of distortion.

Therefore, in listening to a set working, you should try to forget the set itself and bring your critical judgment to bear on to the sounds, and try to gauge how true they are to the original.

What to Listen For.

If there is speaking, note whether or not the s's can be heard clearly and if the p's and b's get through. You can understand human speech even if a lot of the lower and higher notes are cut out, but when this occurs the speech loses its individuality.

One of the finest tests of quality for a radio set is a piano transmission. It takes a very good set indeed to reproduce a piano item so that it sounds like a piano, and not like a kind of xylophone. There is a resonant quality about the piano which gets through properly only on the first-class set. Also, it is to be observed that the piano covers an extremely wide range of frequencies.

Yes, decidedly everyone ought carefully to listen to a set before one buys it. If possible, the listening should be done in one's own home in the conditions under which the set will be operated. Besides keeping one's ears wide open for such faults as an over-emphasis of some of the notes or an absence of others, one should see if there is any tendency towards a muffling of the low notes.

Cabinet Resonance.

Resonance in the cabinet of the set is a common fault. There will always be *some* resonance, but skilful design can reduce it to a level where it is of little consequence.

Many listeners appear to be afraid of high notes, probably because of the tradition that "mellow sets are the best." It is not hard to see how this idea was developed. In the earlier sets there was nearly always serious distortion due to overloading of valves and the absence of properly arranged grid biases and so on.

Allowed free play, this distortion was heard as a harsh breaking up of the high notes that was decidedly unpleasant to listen to. When plenty of condensers or some other such expedient was employed the distortion disappeared—and the reproduction became ever so smooth and pleasant if judged purely at its ear value, as it were.

But all the high notes had been cut off by the drastic cure!

Any listener brought up in the tradition of "mellow radio" would naturally at first consider that a set able to deliver a fair treble was "squeaky."

It is seldom that there are too many high notes even in the best of sets. There may be too much of one or two of the high notes due to some peaking effect. And nothing can be more distressing than a noticeable peak of that kind. Every time the programme item runs up into that area of the audio spectrum "Inginging!" pierces through the ear to the innermost brain cells.

However, modern designers watch for those peaks very carefully, and they do not occur to any real extent in any of the better sets. A treble free from faults and a pretty good bass, that is what you get nowadays if you choose your set carefully.

You can't expect to embrace the whole audio scale with an ordinary domestic outfit; it cannot be done with a first-class laboratory installation, for the simple reason that the B.B.C. is unable to transmit the full gamut.

Nevertheless, the approach to perfection is becoming close. The real test of a set is the realism with which it can reproduce speech and music, and the sets of 1935 can claim a high degree of realism.

We have now dealt with the two most important features, reliability and quality of reproduction. These are qualities which, in our opinion, stand miles above all the others put together. It is true that the set which will not separate the stations is useless, but, being quite useless in the primary function, it deserves no consideration!

But it so easy to design a set which will at least give you the local station and Daventry 5 X X free from interference that if we were examining the point very closely we should have to look a bit deeper for our criterion of selectivity.

Selectivity is bound up with sensitivity, and also to some extent with quality. Always be suspicious of a set for which striking claims of selectivity are made, unless there is also some pretty pertinent information regarding tone compensation.

Now how selective do you want your set to be? You can't have it so selective that it will tune in any of the European stations free from any interference, because, owing to the tangled condition of the European ether, that simply cannot be done.

Choose a Good Make.

But we suppose most people are aware that distant-station listening is something of an adventure to which the simple rules of local-station reception do not apply. That is, with the exception of a few of the nearer and more powerful stations.

Anyway, you have got to leave the question of selectivity to the manufacturer. There are no easy methods of testing for selectivity within the scope of the ordinary listener.

This is just one more reason why you should buy a set bearing the name of a reputable firm; it is the only way in which you can be sure you are getting the full advantages of the modern developments of the technique of radio reception.

And now for ease of handling. A domestic radio set ought to be as easy to handle as a gramophone. There is no reason at all why it should not be. And yet some of even the good makes of sets lack just a little in this regard.

Simple Control.

Single-knob tuning is, of course, all but standard practice nowadays, but a few sets are rather overflowing with supernumerary controls. It is certainly nice to have a flexible, versatile instrument, but if there are to be several knobs, then they should be of different shapes or sizes in order to make them easily identifiable. Clear marking, too, ought to be given to them.

It is desirable that the tuning scale should be easy to read from either a sitting or standing position.

And then there is the appearance of the set. This, too, has its importance, but the set is only a means to an end, and the better it does its job the more you become carried away by that end and the farther into the background falls the set. It achieves its greatest triumph when you forget all about it!

A POPULAR BROADCASTER

HARRY ROY, leader of the May Fair Hotel Dance Orchestra, listening to a programme on a Cossor Universal Model "369" receiver.

The Advantage of HIRE-PURCHASE

Your credit is good, so why shouldn't you take advantage of it and get that modern set which you like so much, right away? That is the sound theme of this article.

By A. S. CLARK.

THE whole world lives on credit! That's rather an amazing statement, isn't it? But it's a jolly sight nearer the exact truth than perhaps you realise.

When you make a cash deal you pay for a thing before you have the benefit of it. When you buy a banana from a fruit vendor you pay for it before you eat it; that's a true cash deal! But the vast majority of things that have to be paid for are in the nature of credit transactions.

When a manufacturer buys thousands of pounds' worth of raw material, he may not write the cheque for it until a year or so afterwards; and when he has made the articles the wholesaler comes along and says he wants three months' credit on the goods he takes.

Similarly, most likely, the retailer only settles up once a month, and so it goes on.

Credit Deals.

Returning to bananas, if you always get yours from the same greengrocer, he probably sends in a weekly bill. Thus you buy your bananas on credit.

Even when you go into a restaurant and order a grilled steak, it is, strictly speaking, a credit deal. You have the goods a certain time before you pay for them, and they certainly could not be returned!

You may not be known at the restaurant, but your appearance is sufficient guarantee that your credit is good enough.

If you went in dressed in a disreputable manner and ordered a five-course dinner, you wouldn't get served. Your credit would not appear good enough. You would be asked for the money first.

Everybody runs to credit for something. Take the doctor's bill, for instance; most of us need pretty long credit when this is heavy. And why not?

But I won't pursue this course any further, or you will be wondering whether I have quite forgotten I am supposed to be a radio journalist. This is what I am getting at.

A Sound Method.

I cannot for the life of me see why some people are so averse to credit terms on goods. Furniture, a motor-car or a radio set can all be purchased in this way. I take advantage of hire-purchase myself; so, I expect, do most of my readers. As a matter of fact, about 80 to 90 per cent of all the trade done in these three lines is on the deferred payment system.

By no means is it always a matter of obtaining something that cannot be paid for right out. After all, if your credit is good, why should you not take advantage of the fact?

It is possible to go into your radio store in the morning, choose a set, and then be listening to it, installed in your own home, by the evening, and all for the small sum represented by an initial payment.

And so the opening of this article is to try and persuade those who deny themselves the modern radio they so desire simply because of an antipathy to credit terms that there is no logic behind their views. The only difference between ordinary credit transactions and hire-purchase is that in one case you wait a certain period and then pay the whole amount, whereas in the other you pay a proportion of the amount after regular small periods of waiting.

But I doubt if many even of those who look on credit terms as a modern amenity quite realise the wonderful value obtainable in radio to-day for the sum of a few shillings or so a week, or the ease with which they can arrange to have a set on hire-purchase and the many advantages of so doing.

In the first place, you pay for your radio entertainment in the same way as you get it, a little bit at a time, and you obtain it from a modern receiver.

I know some people who reckon always to be buying a set on deferred terms. As soon as one is paid for they part exchange it for another, and so they always have a set of the very latest type and never have to lay out a big sum of money. Nor do they meet those troubles and sometimes heavy replacement costs that often go with an ageing receiver.

Free Servicing.

Another point worth remembering is that of servicing. In most cases of sets bought on credit terms free servicing is available if anything goes wrong over the whole period covered by the duration of the payments.

Finally, there is the question of the type of receiver you are able to afford. Taking advantage of "terms" may mean that you are able to have your favourite chassis in radiogram form instead of simply as a table model receiver only. And is not that well worth consideration?

And don't forget that terms are not always confined to a period of twelve months. In many cases payment can be spread over fifteen, eighteen or even twenty-four months.

Some may wonder why it is always possible to quote the exact hire purchase terms in regard to well-known makes of radio receivers and radiograms. The reason for this is quite simple actually, it is because the makers themselves realise the importance of the credit business.

The Procedure Adopted.

In most cases the hire purchase terms are entirely arranged and the transaction conducted throughout by the makers. So far as purchase is concerned you really deal with the maker direct—the agent supplies the set, installs it and carries out the after-sales servicing. It is this interest taken by the makers in hire-purchase which enables the deal to be put through so expeditously. Unlike car hire-purchase, the dealer does not have to arrange a special agreement with some outside financial company, for each individual sale he makes.

LATEST FERRANTI SUPERHET

An interesting description of the new "Nova" receiver for use on A.C. supplies.

The receiver is housed in an artistic cabinet of moulded material in black or brown with ivory inlay.

TO anybody contemplating the purchase of a receiver over an extended period there are two important factors which should not be overlooked. The first is the facility with which the fancied set can be serviced in the event of breakdown, and the second is the likelihood of the set being out of date by the time the payments are completed.

To the lay mind, the first of these considerations may appear to be superfluous, inasmuch as it might justifiably be argued that with a modern set it should not be necessary to contemplate the possibility of a breakdown. It isn't, really, and with modern sets it is certainly a fact that the breakdown percentage is exceedingly small.

Speedy and Simple Servicing.

But despite the most elaborate test precautions in the world, there must always be just that slight element of doubt due to the intricate and delicate nature of the instrument, and while one is not justified in taking the pessimistic view the fact that a set lends itself to speedy and simple servicing cannot be ignored as an argument in its favour.

The new Ferranti "Nova" superhet is a complete answer to both of these problems, and on this score alone, even were it not for the many other fine features of the design, the set warrants inclusion in this special hire-purchase section of "P.W."

Our readers will doubtless be aware, from information which has been published in "P.W.", of the new factory which has recently been opened by Ferranti. The new "Nova" superhet is one of the first fruits of this enterprising move, and if it may be taken as a criterion of what we are henceforth to expect from Ferranti, then there must certainly be some good things ahead.

But to confine ourselves to the present, it must inevitably inspire confidence in the mind of the potential buyer to know that this new set of Ferranti's is a product of their new home, for there is not a factory in the country better equipped for the job. The thoroughness of the manufacturing methods employed and the elaborate precautions taken to ensure reliability in service are the most marked features of the organisation. Nor is that all.

A Far-Seeing Policy.

With that foresight for which Ferranti's are famed, the design of this new set has been carried out with a view to reducing service problems to the simplest possible terms, so that the possibility of long delays and domestic inconveniences may be ruled out altogether.

One cannot but hand the laurels to a firm which takes such elaborate precautions in the first case to guard against failure, while not overlooking that one in a thousand—perhaps even one in five thousand—chance of service being required after sale. It is a noble, far-seeing policy that is deserving of every success; a policy far to be preferred to that of the manufacturer who contemptuously maintains that his products are so good when they leave his factory that the service question can be ignored. While it no doubt saves him a lot of trouble, it is hard luck on the unsuspecting listener, and it is an attitude which experience has proved to be wrong.

RIGID COMPONENT TESTS

All components used in Ferranti receivers are subjected to comprehensive tests, and here is a mains transformer being put through its paces.

Don't trust any set that cannot be easily serviced or for which repair facilities are not promptly available! You may be that one in a thousand to suffer if you do.

It follows that with a set so recently introduced as this one the question of the design going out of date before the payments are completed can be ignored. The new "Nova" is, in fact, ahead of its time, judging by the tests that we have carried out, and it is likely to stand its owner in good stead for many years to come.

In general design it marks a departure in the history of Ferranti receivers, for it is the first set under this famous trade-mark to be housed in a moulded cabinet. The artistic blending of cream and black in the moulding of the cabinet is something quite new, and in our view the result is exceedingly attractive. One thing is certain: it will make an instant hit with the ladies!

The actual set is a three-valve (plus rectifier) superhet, with an astonishingly high performance characteristic. A band-pass filter separates the aerial from the first valve, which is a Ferranti heptode operating as frequency changer with electron coupling. A variable-mu pentode is used for intermediate frequency amplification, and it is coupled with tuned primary tuned secondary transformers.

HOW TO BUY IT

The cash price of this A.C. receiver is 11 guineas, but it is obtainable for a deposit of 25/-, after which 12 payments of 19/- have to be made. The universal mains model costs just a trifle more.

A double-diode-output-pentode in the third position (Ferranti PT4D) combines the functions of diode second detector, A.V.C. rectifier and power pentode output.

A particularly notable feature of this set, and one upon which we have often commented in these columns, is the inclusion of the famous Ferranti "All-In" dial. If you have not seen yet a Ferranti set with this feature in it, it is worth a visit to the local dealer's for the express purpose of examining it, for in our view it is one of the most outstanding dial developments of recent years.

Exceptionally Good Performance.

It provides a visual indication of every control adjustment, and the facility with which distant stations can be identified from the station-name indicator must be experienced to be truly appreciated.

As we have previously indicated, having regard to the fact that this set employs only three valves, excluding, of course, the rectifier, the performance during our tests was exceptionally good We would stress particularly the quality of reproduction, which is no less striking in this set than in any of the other Ferranti receivers, and more than that there is no need to say, for the Ferranti reputation in this direction is world-famous.

The set offers a wide range of alternative programmes under most ordinary domestic conditions, and its daylight range even with a comparatively poor aerial is commendably good.

From every point of view the Ferranti "Nova" receiver is eminently suitable for listeners seeking a reliable instrument for purchase over an extended period, and the generous terms offered unquestionably bring it within the reach of the humblest pocket.

THE EKCO 9-STAGE TRANSPORTABLE

Full details of the model ADT95, a superhet receiver for A.C. or D.C. mains

WHAT is the difference between a transportable and a portable receiver? Well, let's have a look at the meaning of these words according to the dictionary.

"Transportable" means capable of being conveyed from one place to another, and "portable" is defined as easily carried. The makers of the Ekco A.D.T.95 mains receiver describe it as a Superhet Transportable for Universal Mains. But I think the word "portable" is just as applicable to it, for any member of the household, even one of the youngsters, can move it with the greatest of ease from one room to another.

Probably, when the description was being decided upon, the "title makers" were mostly thinking of the fact that this receiver can be used in any room in the house, or in different houses even when the types of mains supply differed. You see, it will work on D.C. or A.C. mains of any voltage between 200 and 250, and does not require the attachment of either an aerial or an earth wire.

Only One Lead.

There is only one lead coming from it, and all that it asks is that a mains point shall be available from which it can take the necessary power. Give it that, and in return it will give you all the radio entertainment you want—amazing volume, attractive quality, wide choice of programmes.

With one of these sets you can have radio in any room you like without a single extension wire, you can pull down that unsightly pole in the garden and you can ignore the fact that a kindly grid-system may cause your mains to be changed from D.C. to A.C., or that you may at some time move to a district where the type of supply is different from your present one. And while obtaining all these advantages you only have to pay about 6/- a week towards the cost of the receiver, which will be fully paid for in a year.

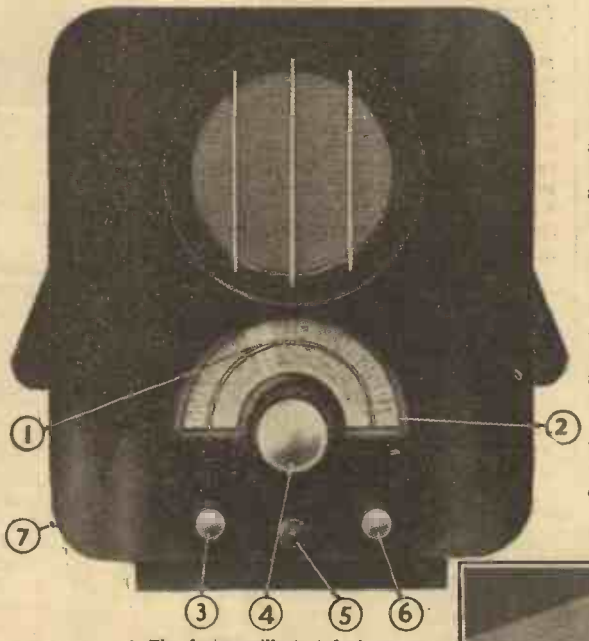
WHAT IT COSTS

15 guineas is the cash price of this receiver.
It may be obtained for a first payment of 27/- and 12 monthly payments of 27/-.
The black and chromium finish costs a trifle more.

Do you know of a more attractive proposition in the radio line? But perhaps you are still not convinced, perhaps you feel that surely you must be sacrificing something in order to gain so much.

Take the word of one who knows from first-hand experience of the set, and from a technical understanding of what goes to make up a reliable modern radio chassis, that you are not. By availing yourself of the easy terms for obtaining an Ekco Nine-stage Transportable for Universal Mains, you gain everything and lose nothing.

IN BLACK AND CHROMIUM



The features illustrated above are, 1, the shadow-tuning; 2, the station-calibrated scale; 3, volume control; 4, tuning; 5, static suppressor; 6, wavechange switch; and 7, on-off switch.

Ah! you may think, I see the catch: it's got nine stages, and therefore must be expensive to run. You're still wrong!

Actually, all the set consumes is 70 watts on A.C. mains and even less on D.C. That's less than the power often used to illuminate a single room, and no one thinks twice these days of the extra cost of switching on another light.

Although there are nine stages in this receiver, only six valves in all are employed. That is because full advantage is taken of the modern multi-valves that are really two or more valves in one.

Amazing Sensitivity.

Let me tell you something about the features and advantages of the circuit without waxing too technical. First of all the selectivity and sensitivity are amazing for the size of the set and considering that it works from small frame aerials entirely contained within the confines of its attractive cabinet. Its actual dimensions are 17¾ inches wide, 18¾ inches high, and 10 inches deep.

Full delayed automatic volume control is present, as in all the best receivers, but there is additionally a switch which enables static-suppression to be instantly brought into operation. When this is working only those stations which reach a volume level that is bound to be above any ordinary static-interference volume are received. All others are automatically suppressed, and the space on the tuning dial in between these stations of programme value is completely quiet and dead.

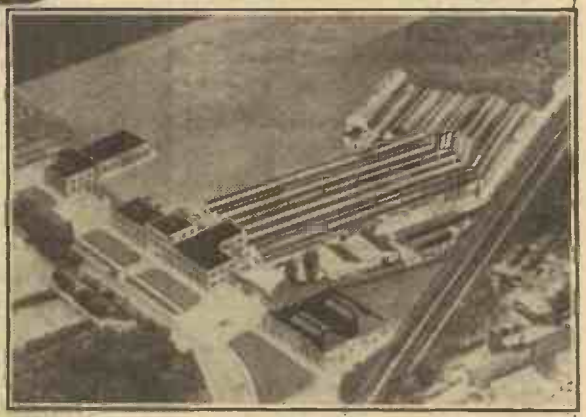
Mention of the dial reminds me to tell you that it is calibrated in station names, and that the scale is interchangeable should alterations in the wavelengths of broadcast transmitters make this necessary. As tuning is carried out a band of light travels round the scale, and a thin shadow line in the middle of this band indicates the exact tuning position.

Equipped With Turntable.

Tone control is provided, and the wavechange switch is marked with coloured dots which correspond with colour indications on the tuning scale and so instantly make clear the waveband to which the set is adjusted.

A turntable is mounted on the base of the instrument to enable it to be conveniently swung in any direction, and two distinct cabinet finishes are available,

WHERE THEY ARE MADE



An aerial view of the extensive Ekco factory at Southend-on-Sea.

figured walnut and black with chromium-plated fittings. Personally, I think the latter is the most attractive radio-set finish ever devised, and it "goes" with any furniture. And so I could go on picking out and mentioning refinement after refinement, and feature after feature. But I have written enough to convince you that this is a receiver in a class of its own, and one worthy of the highest commendation.

It comes from a world-renowned factory, a hall-mark in itself of reliability and a guarantee of satisfaction.

A. S. C.

A NEW TUNING INNOVATION

"Thermometer tuning" is a feature of the Cossor Model "364" superhet dealt with on this page

"THERMOMETER tuning" is a Cossor innovation.

To those of our readers who are familiar with Cossor progressiveness—and can there possibly be anybody who isn't?—this will instantly convey tidings of something really good. Nor, in the description which follows, are they likely to be disappointed.

DETAILS OF COST

The Cossor Model "364" is obtainable for £1 down and 12 monthly payments also of £1. The cash price is 11 guineas.

It may be said that, as far as the ordinary listener is concerned, the general efficiency of all the leading makes of sets is of such a high order these days that the difficulty is no longer in *getting* a whole gamut of distant stations, but more particularly in *identifying* them.

It follows, therefore, that any development which has as its objective the simplification of distant station identification may be hailed as a development of first-class importance. And without the slightest shadow of doubt "thermometer tuning" is a development of this order.

The last twelve or eighteen months has seen the introduction of many commendable tuning devices, and it must, in fairness, be said that in the design of the majority of sets these days this question of knowing "where you are" is given proper consideration.

An Ingenious Device.

Station naming on the actual tuning scale has become almost standard practice, but perhaps not all of the pointer and other devices for indicating the names are entirely above reproach. We have had sets submitted to us for test time and again in which an attempt at a brilliant idea has been spoiled *through the indicator covering the name of more than one station at a time.* That may be good enough for the expert, but it isn't for the man-in-the-street.

But this new device of Cossors—typical absolutely of the organisation behind it—is truly ingenious, and it is one of the few reliable station-naming schemes which may truthfully be said to have no attendant disadvantages.

That is but one of the many reasons why the new Cossor model "364" receiver, in which it is incorporated, is assured of instant success. The fact that a set—perhaps we had better say a Cossor set—with such an advanced feature is available on terms equivalent to only five shillings a week will, in itself, be sufficient for most people, but that is only the fringe of the story.

From the detailed description which follows it will be apparent that Cossors are not content simply to sell an idea—albeit a brilliant idea—with little or no particular regard for the instrument on which it is presented. Their enviable reputation means far too much to them for that. Little wonder, therefore, that in the design of this latest all-electric A.C. superhet they have succeeded in producing an instrument which, price for price, has few to equal it and certainly none to better it. But we shall have more to say about that later.

In the meantime, what is "thermometer tuning"?

Accuracy of Calibration.

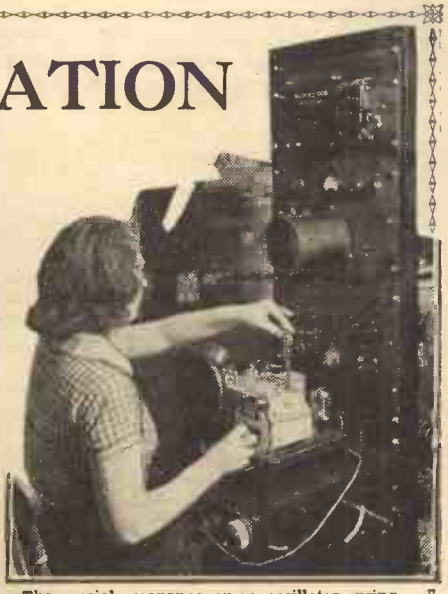
Consider the design of an ordinary thermometer, wherein a calibrated scale and a rising and falling column of mercury enable you accurately to determine the temperature. By a clever variation of this idea a black column is made to rise and fall in sympathy with the movements of the main tuning control and the station names and wavelengths take the place of the temperature calibrations on an ordinary thermometer.

Actually, there are two "thermometers" in this latest Cossor set—one for medium-wave stations and one for long waves—and the appropriate scale is automatically illuminated according to the waveband in use.

The advantage over certain other methods of this rising and falling column for the identification of station settings will be readily apparent, and apart from the fact that it must inevitably make for greater accuracy of calibration with such an opened-out scale, it is much more determinate in use.

So much for the ingenious tuning arrangements. But what of the set itself?

In keeping with modern tendencies—one might almost say in keeping with modern requirements—the "364" is a superhet: a superhet according to the Cossor idea, which, as may well be imagined, is something out of the ordinary.



The special resonance curve oscillator, using the Cossor cathode-ray oscillograph tube, used to ensure a hitherto unobtainable degree of accuracy for ganging of Cossor receivers.

FOR USE ON A.C. SUPPLIES

Among the many features of this receiver is the ingenious tuning scheme. This is fully explained in the text.

The actual receiving chain comprises four valves—a pentagrid frequency changer, an H.F. screened pentode intermediate frequency amplifier, a double diode second detector, and a high slope pentode output valve. The combination is conventional enough, but that the circuit is something exceptional is quite apparent from the remarkable performance of which this set is capable.

Of particular appeal to the ordinary listener, too, is the ease with which the set can be operated. There are but three simple controls—one for tuning, one for volume, and a four-way switch with positions for off, medium waves, long waves and gramophone. At the back there are plugs and sockets for the connection of both pick-up and extension loudspeaker.

Wide Choice of Programmes.

A total of 39 stations—the pick of the European programme providers—are actually indicated by name on the "thermometer" scales, but from our own practical tests of the "364" this would seem to be a very modest indication of the set's capabilities. We found it possible without much difficulty to tune in many more stations than this, which alone speaks volumes for the overall sensitivity of the instrument.

But quality these days must always count for more than quantity, although when, as in the present case, the reproduction aspect of the set's performance can be so highly praised, then there is about this fine instrument something which reminds one irresistibly of the jam being on both sides of the bread!

Cossor sets have always been renowned for their quality of reproduction, and this latest example is no exception to the general rule. It is neither overdone at the bass nor "underdone" at the "top." It is, in fact, just as it should be—*natural!*

In short, this model "364" is a set which we can thoroughly recommend.

AN ATTRACTIVE CONSOLE FOR THE CONNOISSEUR

Details of "His Master's Voice" "Console Superhet Five" receiver, designated Model 444.

MARVELLOUS! That one word is a true and unexaggerated description of the "H.M.V." Model 444 "Console Superhet Five."

The photographs of it on this page will help to give you some idea of its attractive appearance and general features. The fact that it stands on the floor and does not require a table to carry it gives it an importance of bearing never attained by the consolette type of receiver. But there is also a technical advantage in the cabinet style.

First of all it permits of a large baffle area, a necessity in obtaining richness of bass. Secondly there is more space behind the speaker, giving a natural freeness to the reproduction not always obtainable when the cabinet is very small and the design extremely compact.

A Practical Refinement.

The instrument is twenty inches wide, nearly a foot deep and stands a little under three feet in overall height. This height has been very carefully chosen, for it permits the tuning scale to be arranged so that it is very conveniently placed for tuning, both when sitting in an armchair and when standing.

If a scale is arranged vertically it is fine for tuning when sitting down, and if arranged horizontally it is ideal for a standing position. But by arranging it sloping at an angle at the top of the cabinet the makers of this console have achieved a compromise which enables tuning to be carried out with perfect ease in either posture.

THE PURCHASE PRICES

Cash Price: 17 GUINEAS.

or

£1-17-0 down and 18 payments of £1-0-0

or

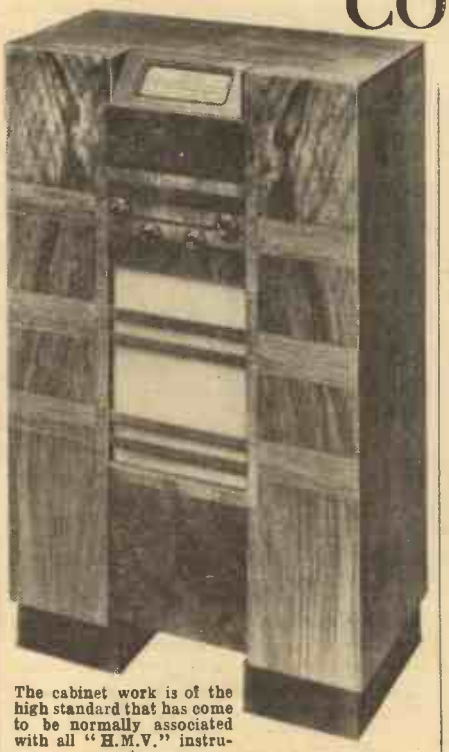
£1-16-0 down and 12 payments of £1-8-9

The cabinet work is of the high standard that has come to be normally associated with all "H.M.V." instruments, and is in figured walnut and zebrana. The style, while striking a modern note, is nevertheless unobtrusive and would appear elegant in a drawing-room furnished in the finest manner.

High Quality Reproduction.

So much for the visual and artistic considerations. Now, what about the aural qualities?

Here we are getting nearer to technicalities, but in no wise does our enthusiasm abate one little bit. We have already mentioned how the cabinet aids first-class quality by its design, and there is no shadow of a doubt that the quality of the output from the speaker *is* first-class.



The cabinet work is of the high standard that has come to be normally associated with all "H.M.V." instruments.

The loudspeaker is mains energised, and is a new type of instrument, the cone of which is made by a secret process in the "H.M.V." works. And it is not necessary to have the "wick turned up" to reap the full benefit from the speaker. A special tone-compensator is incorporated which keeps the balance of high and low notes just right, no matter what the position of the volume control.

Finally, we may mention that the operation is genuinely simple, and "images," namely, stations tuning in at more than one position on the dial, can never occur, due to the special circuit used. So, all told, do you wonder we have described this receiver as a set for the connoisseur?

"Certainly not!" you will agree, but you may add: "But connoisseurs generally have unlimited means at their disposal." Whether that be true or not, it has no bearing on the present matter!

This set costs seventeen guineas. Perhaps that *is* more than you would spend on a receiver—if you were going to buy it outright. But you don't have to, you know. That is one of the attractions of hire-purchase.

The terms for obtaining one of these receivers on deferred payments are set out on this page, and you will see that they are but little more than you would pay for an ordinary sort of set. But the extra, you will agree, is of little consequence when it enables you to have such an outstanding instrument, one that is above the general run—in fact, as we have already said, a set for the connoisseur.

There are five valves in all, including the indirectly-heated rectifier. Apart from the latter, there are the heptode oscillator, intermediate amplifier, detector and two-watt output pentode valves.

Automatic Volume Control.

The detector also acts as first L.F. amplifier and automatic-volume-control valve, the A.V.C. being applied to the heptode as well as the I.F. amplifier.

The A.V.C. is adjustable so that silent tuning may be obtained if desired in between stations, and also so that the stations which come in shall be above the interference noise-level in any particular district.

Provision is made for the connecting up of a pick-up, and also for an external loudspeaker. A commendable feature of the latter connections is that the extension speaker may be of either the low- or high-impedance types.

The control knobs, of which there are four, are all mounted above the loudspeaker fret and a little way below the illuminated tuning dial. One knob is for tuning, one for volume adjustments, one for tone and the last does all the switching — on-off, wavechange and radiogram. C. M.

CONVENIENT TO TUNE

The tuning dials and controls are so arranged that operation is delightfully easy whether the listener is seated or standing up.

A MARCONIPHONE "ANY-MAINS" RECEIVER

Some Notes on the four-valve Model "223" Reflex Superhet, which works on A.C. or D.C. supplies

THE unification of the country's electric supply mains under what is known as the "grid" system is forging rapidly ahead, and every month sees the completion of still another link in this gigantic chain.

But not until the last link is forged—perhaps ten or even twenty years hence—will the problem of mains receiver interchangeability be completely solved, at least, not unless every set manufacturer standardises on what are known as "universal" models or, in other words, instruments that can be used on either A.C. or D.C. mains without alteration.

It is because of the element of uncertainty which must always be present pending the completion of this vast unification undertaking that certain manufacturers have produced models which are, to all intents and purposes, completely interchangeable.

And to whom can these models make a stronger appeal than to the listeners who purchase their sets over an extended period? Not for twelve months, or even longer, are the payments completed, and you can imagine what your own feelings would be like if, through a change of mains, your set was rendered useless when perhaps only half of the time had elapsed!

Nobody can be absolutely certain. Who knows, you may have to move to another district, where perhaps the supply mains are different. Then, again, there is the possibility that in the march of progress your existing supply mains may be changed.

Anticipating the Future.

It will be apparent, therefore, that the whole secret of successful credit-buying lies in being able within reason to anticipate the future. And if you pin your faith to a universal receiver, then you can fit it and forget about it. Whatever may happen to your mains need not concern you in the slightest, far less inconvenience you.

In introducing you to the new Marconiphone model "223" receiver, we feel justified in calling attention to this question of mains supply, for the set in question is perhaps one of the most outstanding examples of an "any-mains" set that has yet been produced.

The reason for that—a reason which was very evident in our practical tests of the instrument—is that it is one of the few universal sets which can truthfully be said to compare in performance with that of the best existing type of A.C. receiver. Hitherto it is no secret that a certain amount of efficiency has had to be sacrificed for the attainment of mains interchangeability, and possibly for that reason universal types of sets have never made startling headway.

That Marconiphone should thus have stepped into the breach with this outstanding production is in keeping with the highest traditions for which they are famed, and it should act as a powerful stimulant to the future popularity of universal receivers.

The model "223"—which is one of the Marconiphone Jubilee Year releases—is a four-valve (including rectifier) superhet with a birthday as recent as May 1st this year. That last fact is significant, for it is the latest Marconiphone set to be released, and that it therefore incorporates all the most up-to-date ideas in modern receiver design will be obvious.

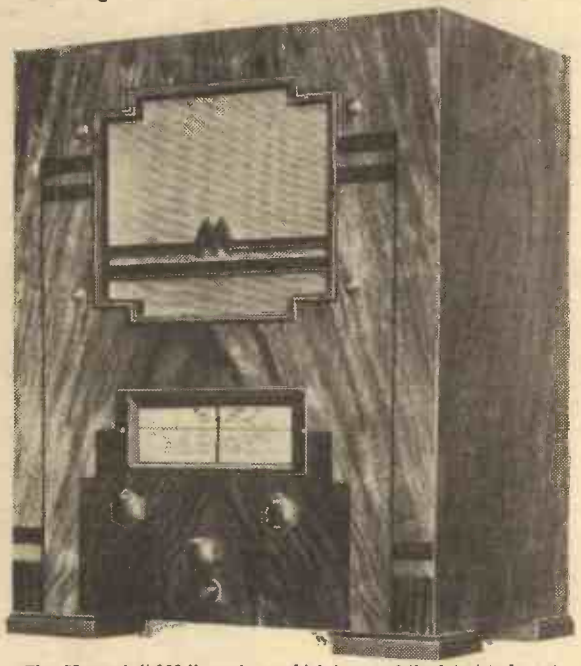
That fact alone should go a long way to influence anybody who is thinking of buying a set over an extended period, for far from the possibility of the set being out of date by the time the payments are completed, here is an instrument that will be in keeping with modern requirements for many years to come.

HOW TO BUY IT

All you need do is to pay £1-10-0 down and follow this with 12 monthly payments of 19/-.

The cash price is 11½ guineas.

QUITE A RECENT RELEASE



The Marconi "223" receiver, which is one of the latest to be put on the market by this firm. It was introduced on May 1st.

The "223" is a reflex superhet with full delayed A.V.C., Marconi multiple universal valves and moving-coil speaker. The circuit comprises a heptode frequency changer, a double-diode-pentode (which combines the functions of I.F. amplifier, second detector, A.V.C. rectifier and L.F. amplifier) and finally a Catkin output pentode. The fourth valve, which is a Marconi U.30, acts as an H.T. rectifier if the set is being used on A.C. mains or as a low series resistance when the set is being used on D.C. mains. The controls, which are three in number, consist of one for tuning, one for volume and one for wavechanging, with a supplementary sensitivity switch which can hardly be regarded as a control in the operating sense. The main on-off switch is situated on the left side of the cabinet.

A Wide Vision Scale.

To the listener who is particularly interested in the reception and identification of distant stations, the tuning scale provided on the Marconiphone "223" will be of instant appeal. It is of the wide vision rectangular style, carrying both wavelengths and station names, and it is uniformly flood-lighted. With the particular instrument submitted to us the positioning of the station names was commendably accurate, and from dial indication alone there was not the slightest doubt about the identity of the many stations that we heard. And during the course of our tests we heard literally dozens of them.

It is a fact that the sensitivity of this fine set is of a very high order indeed, and anyone using it can be assured of a whole gamut of alternative programmes under widely varying conditions. This is due not only to the high sensitivity of the set, but also to the effectiveness of the automatic volume control circuit incorporated.

The quality of reproduction of the "223" is good; very good; and the undistorted output of 2½ watts of which the set is capable is considerably in excess of what is required for normal domestic listening. The total power consumption, incidentally, is approximately 90 watts.

Finally, a word must be said concerning the inlaid walnut and Macassar ebony cabinet in which the "223" is housed. The "223" cabinet is not flashy or ornate; it is just dignified and beautiful; indisputably an asset to a furnishing scheme—nothing more or less than a piece of furniture itself.

REALLY LIGHT!

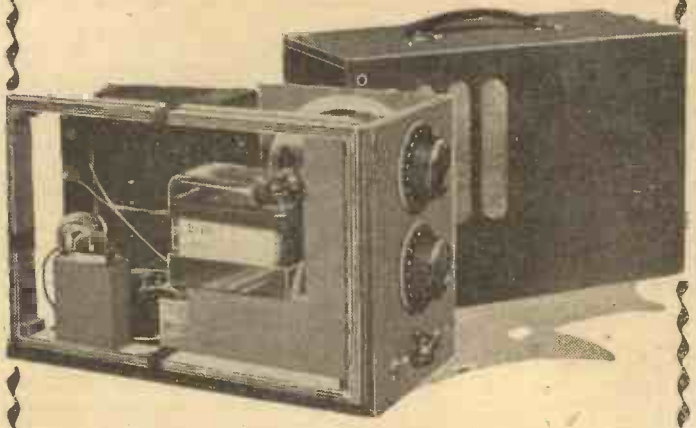
★

WONDERFULLY COMPACT!

AMAZING VOLUME!

★

SUPERB TONE!



A real portable design—an efficient all-in moving-coil-loudspeaker outfit that is lighter and more compact than others, can be carried about with ease, and which, nevertheless, enables you to have good speech and music wherever you go.

ALSO IN THE SAME ISSUE

MORE ABOUT THE HEXOVERTER

By

JOHN SCOTT-TAGGART

M.I.E.E., F.Inst.P., Fel.I.R.E.

Further details for operating the magnificent adaptor for short waves that is the first home-constructor short-wave unit by this famous designer.

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BARRY KENT CALLING

News and Views from the "Big House"

More Ballads.

I HEAR the B.B.C. has decided to give us more ballads, both by more frequent ballad concerts and also by more repetition of ballads in popular concerts. This is a move that will be widely welcomed. Ballads have been neglected in recent years.

* * *

Empire News Troubles.

In obedience to the clamour of its listeners overseas the B.B.C. has been steadily improving its news bulletins in the short-wave Empire programmes. There has been a curious sequel. Overseas newspapers and journals are objecting. They claim that the B.B.C. news service is cutting into their territory and injuring their interests. The complaint will be examined by the Ullswater Committee.

Mention of the Ullswater Committee reminds me that among recent witnesses was Sir Harry Brittain. It is also stated that members of the committee have been carefully examining the books that have been written recently on broadcasting.

* * *

Television Progress.

The progress of television has definitely accelerated. The Selsdon Committee, having broken its four months' silence, is now trying to make up for lost time. I believe the difficulties behind the scenes have been composed owing chiefly to the tact of Lord Selsdon himself. Both the Baird and E.M.I. systems are to be used side by side, and the service will be in full operation for London at the beginning of next year.

* * *

"Rocky Mountaineers."

Bill Campbell, the brilliant Canadian producer, who is in England for a few months, is to put on for the B.B.C. a special Hill-Billy programme to be called "Rocky Mountaineers." With Mr. Campbell will be associated Al and Bob Harvey, star visiting artistes from Canada.

* * *

Nottinghamshire Undivided.

The long battle about whether Nottinghamshire was to remain in the Midlands or be transferred to the North of England Region of the B.B.C. is at last concluded. The Midlands have won. More than this, there is a gain in facility because, in future, if a programme of any importance is broadcast from North Nottinghamshire, whether as an O.B. or from the Birmingham studios, it must also be radiated from the North Regional transmitter at Moorside Edge.

American Interest in B.B.C.

There is a great new outburst of interest among Americans in the B.B.C. They tell me round at the "Big House" that there is a constant stream of journalistic visitors from the other side. This new interest has been stimulated by the development of the exchange of programmes and by the curiosity of Americans to see for themselves how public service broadcasting works. There is also a growing irritation "over there" in connection with advertisements on the air.

"GERT AND DAISY"

ELSIE AND DORIS WATERS, the popular stage and B.B.C. vaudeville stars. Studied piano and elocution at the Guildhall School of Music—Elsie also studied the violin. Commenced their professional career about 1923, and first broadcast in 1927. Invented "Gert and Daisy" four years ago. Have had several plays written for them at the B.B.C., but write most of their own material for variety.

The Central Advisory Council.

The new B.B.C. Central Advisory Council, which came into being a few months ago with such a flare of trumpets, seems to have been satisfactorily tamed. Its second plenary meeting took place just before Whitsun and there was not a murmur about it for public consumption.

* * *

Silent Fellowship Demands.

I hear that there has been an astonishing post about the Silent Fellowship, which the B.B.C. stopped six months ago. It is estimated that more than 100,000 listeners made some kind of representation either to the Regional offices or to London. It seems that Mr. E. R. Appleton had an enormous personal following which is not letting the Silent Fellowship just slide into oblivion.

As a matter of fact, I think this is a case in which the B.B.C. did wrong in withdrawing such a service without substitution. No doubt it is a matter which will claim the attention of the Ullswater Committee, if only because of the apparent ineffectiveness of strong public opinion on a justifiable proposition such as this.

ON THE AIR

Our broadcasting critic discusses recent programmes.

THERE was a time when I thought that gramophone recitals didn't need an individual to sponsor them. I held that view even when Christopher Stone was at the B.B.C. It was after he left that I began to recognise the value of the sponsor. Gramophone recitals have been gradually getting lower in my estimation as broadcast fare. I chanced to listen the other evening to a recital given by Francis Toye. I was reminded immediately of the good old days of the Christopher Stone age.

Of course, you cannot compare Francis Toye with Christopher Stone. They are so different in their manner and method. Francis Toye speaks with greater authority, but pleasingly so. Gramophone recitals do need competent sponsoring, and in Francis Toye I feel the B.B.C. have the ideal man.

* * *

It isn't often I comment in these notes on big music, although I often listen to it. I am being unusual, then, when I say a word or two in praise of the 5th concert of the London Music Festival, conducted by Arturo Toscanini. It was Brahms' No. 4 Symphony in E minor that especially attracted me. This is a beautiful work, in my opinion, and a favourite of mine. I listened to it in a room lit only by firelight. I like to listen to music thus. With no distractions one can concentrate entirely on the music. This was a thoroughly enjoyable broadcast.

* * *

I could only look in (or, rather, listen in) for a minute or two at the broadcast of the Trooping the Colour. These morning broadcasts are only for privileged people. Hence the value of those sound picture recordings which are often put on later in the day. These are a great boon to thousands of listeners.

* * *

Comparatively speaking, it was a dull relay that Mr. Lyle gave us this year of the Derby. It wasn't his fault, but the weather's. As colour was missing in the picture Mr. Lyle described, the picture he gave was naturally of mackintosh brown and umbrella drabness. In the race itself, Mr. Lyle was O.K., although he sprang a tremendous surprise on us all by avoiding any mention of Robin Goodfellow till the very end, and that was to tell us that this horse had finished second. I may say that "my horse" was mentioned in a way that raised hopes. But this was early in the race. The rest of the story can be guessed.

As Popular As Ever.

The Old Music Hall programmes are as popular as ever. The Trocadero and South London songs, arranged by Willson Disher, were as good a collection as he has ever made of these old-time songs. And that great foursome of artistes who put these songs over for us! They never seem to have an off-night. It was disappointing not to hear Louie Freear. Unfortunately I missed the announcement (if there was one made) that she was not going to appear.

* * *

"Liebelei" fulfilled all the requirements of good radio drama. The dialogue was brisk and the action of the play was speedy. I am not quite certain, however, that these stories of Viennese life aren't getting a bit played out. We have had rather a surfeit of them, one way or another. But that is by the way. The small cast of "Liebelei" was well chosen.

* * *

"Liebelei" has been done on the films, where Christine ends her disappointed life by throwing herself out of her window. In the radio version she is made to leave the room, never to return. There are several references in the dialogue to this window. Its height from the ground floor, for instance, is commented on, and the wonderful view it commands over neighbouring housetops. I doubt whether listeners unfamiliar with the picture would guess Christine's real end.

* * *

Glen Byam Shaw (Fritz) and Thea Holme (Christine) were the central figures of the play. They both

(*Continued on page* 414.)

FLUORESCENCE

By J. C. JEVONS

An extremely interesting explanation of the peculiar but valuable phenomenon produced by X-rays and cathode rays. Without fluorescence there would be no viewing screen as we know it now and cathode-ray television would be impossible.

IN order to improve the standard of cathode-ray reception, scientists have been trying for some time to find a fluorescent material capable of giving off a more brilliant light than that usually obtained under the action of the electron stream. According to recent reports it seems that their efforts have now proved successful, though details of the new discovery are not yet available.

At present the size of a cathode-ray picture is limited by the fact that it is produced inside the glass bulb. A larger picture requires a larger tube, and this in turn involves a higher initial cost, and so one finds oneself in a vicious circle. Of course, lenses can be used to give a certain degree of optical magnification, but this is limited by the low intensity of the fluorescent light coming from the screen. With a more "brilliant" screen it would at once be possible to magnify the picture up to reasonable size without any noticeable falling off in definition.

Rather a Mystery.

The production of fluorescent light is, in itself, something of a mystery. The ordinary out-of-doors effect produced on the surface of certain crystals, such as fluor spar, or seen coming from paraffin oil, or a solution of quinine, is essentially due to reflection. Unlike phosphorescence, it only lasts so long as light continues to fall on the fluorescent surface.

In phosphorescence the incident light is stored up and given out again some time afterwards, but in fluorescence there is no appreciable lag. Otherwise a fluorescent screen could not be used in television, because one picture would persist long enough to overlap the next, and the whole effect would be blurred.

But—and here is an interesting point—fluorescence is not due to reflection pure and simple, because the wavelength of the light given off is not the same as the wavelength of the incident or original ray of light. In every case the visible fluorescence is longer in wavelength—or lower in frequency—than the ray which excites it.

The Frequency is Changed.

It is instructive, for instance, to compare this with what happens in the case of reflected sound. When one throws one's voice against the side of a hill, the echo which comes back, though weaker in intensity, is unaltered in pitch. In other words, the frequency of the note which comes back is not altered merely because it has been reflected. Neither is the colour of monochromatic light changed by reflection in a mirror. But the light coming from a fluorescent substance is always "stepped down" in frequency. The explanation is to be found in the action of the atom which reflects it.

Why one substance should be fluorescent and another not is still a mystery. We do know, however, that the effect itself is due to the impact of external electrons producing a sudden shift of the electrons inside the atom. More usually the cause is a ray of ordinary light, though in the cathode-ray tube the fluorescence is produced by electronic bombardment. But in both cases the original balance of the atom is upset, and in the process of readjustment light waves of a lower frequency are thrown off. In short, fluorescence (like colour, transparency, and most other physical properties) is due to the atomic make-up of the substance concerned.

We also know that X-rays are capable of producing a more brilliant fluorescence than ordinary light rays. Possibly one clue to the production of brighter television pictures is to be found here. Instead of bombarding the screen directly with electrons we shall first convert them into X-rays and then use the latter to illuminate the screen. Incidentally, this would also allow the screen to be mounted outside instead of inside the bulb, because X-rays will readily pass through the glass walls of the cathode-ray tube.

Another possibility is to replace the fluorescent screen by one capable of glowing or incandescing. Mr. Baird has already suggested the use of a very thin sheet of platinum, divided up into squares so as to form a "mosaic" screen. The various squares of the mosaic are raised to different degrees of heat by the bombardment of the electron stream, so that the intensity of the light given off by each square reproduces the corresponding tone value of the original picture.

The fine subdivision of the metal screen prevents the spread of heat by conduction from one square to the next, which would of course blur the detail of the picture. Instead of using a mosaic of squares the screen can be made by "sputtering" finely divided metal particles on to a plate of glass or other insulating material.

Materials for the Screen.

One of the best known of the fluorescent materials is zinc sulphide. In its ordinary state this is also definitely phosphorescent, so that it is not suitable for use as a television screen. But when mixed with a small amount of radioactive material, such as mesothorium, which continually excites the phosphorescence, it is commonly used to illuminate the dials of watches, range-finders, and other similar indicating devices.

For cathode-ray work a fluorescent screen of willemite or zinc silicate is suitable for low-voltage tubes, and cadmium or calcium tungstate for tubes taking up to 2,000 volts on the anode. If zinc sulphide is carefully purified by chemical treatment it will give a pleasant blue-white fluorescence free from any trace of after-phosphorescence.

A very efficient television screen consists of a mixture of cadmium tungstate which produces a bluish light, with zinc phosphate which gives a red colour. When used with anode voltages of the order of 1,000, the two effects blend together to give a colour approximating to natural or white light.

Controlling the "Light."

The presence of certain foreign bodies, such as traces of nickel in zinc sulphide, has a very peculiar effect. They appear to act as "poisons," and if present in large quantities finally cut off the fluorescence almost completely. On the other hand, small traces of nickel serve a useful purpose in helping to regulate the amount of phosphorescence shown by the sulphide.

As previously stated, "lag" due to phosphorescence is definitely undesirable in high-definition television, where the effect of the spot on the screen should be rapid and clear-cut. But for 30 and 60-line working, a certain amount of persistence or "overlap" between one picture and the next may be quite useful in helping to reduce the effect of flicker. For this reason a certain degree of phosphorescence is sometimes deliberately introduced into the sulphide used for making the screen.

A FAMOUS SINGER

Miss Olive Groves, the well-known radio star, is here seen in the television studio at No. 16, Portland Place, whence low-definition television broadcasts are made.

"YOU CAN'T FOOL THE MIKE"

says Berthe Grossbard, famous Rome announcer and lady journalist, in an exclusive interview with Alan Hunter.

BERTHE GROSSBARD

TO meet Berthe Grossbard is a salutary experience for anyone who imagines British broadcasting is not only the finest in the world, but has a universal appeal. For Berthe will tell you that the Italians do not like our announcers. Can you imagine that?

Yet, listening to the musical singsong of the Italian announcers, especially the corps of lady announcers, among whom Berthe Grossbard is numbered, one begins to understand. By comparison our passionless diction must seem somewhat uninteresting.

Well, I thought, we will pass over announcers, contenting ourselves with the reflection that at least our policemen are still wonderful to the foreigner—even to such a highly critical visitor as Berthe Grossbard.

About Our Dance Bands.

But I had not heard the worst. She had nothing to say in favour of our dance bands. As for our musical broadcasts, why the Italians could not learn anything about good music from us. As I say, somewhat salutary!

Yet this charming radio journalist from Rome is not an Italian.

"I was born and educated in Vienna," she confessed to me. "How did I become a Rome announcer? Ah, that is a long story."

So we had tea in the Langham, under the shadow of British broadcasting, and I heard all about it.

"Professor Friedrich Rosenthal, from the Wiener Burgtheater, discovered my qualities, and I went on the stage. Professor Kestranek, from the Royal Academy in Vienna, cultivated my speech. I played for several years in Germany.

"Very soon, though, an intimate colleague of Reinhardt discovered my abilities for broadcasting. For several years I worked at German broadcasting stations and at the Vienna broadcasting station, giving talks and taking part in radio plays. And now, for two years, I have been working very happily at the Rome station, giving regularly a weekly talk written by myself."

Berthe Grossbard is more than an announcer. She is a keen commentator on Italian culture. Her talks are delivered in German, for the Rome station is nothing if not international. She takes her job very seriously, believing deeply in the power of the microphone to detect the slightest sign of insincerity.

The radio speaker, she maintains, must have something to say. "The radio speaker must have a radio station in his own heart," as she rather poetically puts the matter.

She pictures herself as a voice breaking in upon the domestic scene. The mother is in the kitchen, the boy doing his homework, the father just home from a tiring day's work. The sound of her voice must force these people to listen—or the radio speaker will have failed.

The Need For Sincerity.

And how does the good Berthe grip her audience? She says only by her sincerity. "And what is sincerity at the microphone?" I asked.

"A complete belief in what you are saying," insisted Berthe. "It is complete concentration on what you are saying. You can disguise your thoughts with a visible audience, never at the microphone. The microphone is a sort of heathen god. It demands total worship! Even a momentary absence of mind spells boredom for the listener at the other end."

Berthe Grossbard is an actress who has realised a major secret of microphone technique. She has realised how the seemingly cold and callous microphone always yields to blandishments—so long as they are sincere.

An Entirely Natural Voice.

I have heard Berthe from Rome. A full, warm sounding voice, entirely natural, full of life, vibrating with dramatic intensity, yet, withal, simple and devoid of artificial rhetoric.

You may have heard her in "Spring Comes to Europe" recently. She hopes to return again to England in the autumn. I left her planning to fly back to Rome in seven hours from Croydon. This day and age!

THE recent Jubilee celebrations are still echoing round the gramophone recording studios, judging from the latest lists that have reached me.

Two noteworthy releases that illustrate this fact are Decca K756 and F5551. The former record is of Marius B. Winter and His Orchestra playing the melodies that they played at the recent Guildhall State Ball, when the City of London entertained Their Majesties the King and Queen.

Marius was chosen to play at that ball, and the programme of old-time waltzes and other dances were submitted to the King before the ball. Brief excerpts of the numbers are played on K756 under the title of *State Ball Memories*, and the record provides a very tuneful and enjoyable few minutes melody.

The other record mentioned above has a quite different setting. Its title was inspired by the sight of a banner across one of the poorer streets of London and bearing the inscription *"Poor but Loyal."* The record aims at capturing the spirit of that street, with its children rejoicing and celebrating as only Cockneys can. George Buck is the mainstay—of the record and is assisted by "The Jubilee Kids." It is quite a good idea and should be popular in many homes.

"POOR BUT LOYAL"

* * *

Ambrose and his orchestra are having a good field day in the Decca list. I mentioned this band last time, and so will not give much space to it here. But I must draw your attention to the records F5550 and F5559, whereon are recorded such variety as *Ambrose's Tiger Rag* (the new version, of course) and *I've Got a Note*, a real gem, in my opinion, together with *The Girl with the Dreamy Eyes* and *In the Merry Month of May*. I think you will like both these records.

A completely novel method of rendering that famous dance classic, *Ah! Sweet Mystery of Life*, which is now included in the film "Naughty Marietta," has been recorded by Parlophone on F163, together with *'Neath the Southern Moon*. It is provided by Eddie Carroll and His Music, and contains a vocal duet by Sylvia Cecil and Hendrik.

The result is an unusual record which is particularly pleasing because of the way it is sung. I like it and think most of you will too.

Another Parlophone of note among the dance records is the *Waltz Medley* played on the piano by Fred Stein. It is carried out in strict dance tempo and includes such old favourites as "Charmaine" and "Deep in My Heart, Dear." The number is F168.

* * *

If you want something hot, try *Tiger Rag* played by Nat Gonella and his Georgians. It is another Parlophone, and is probably the finest rendering of that "classic" that I have heard. For sheer brilliance of recording it is an outstanding disc. The other side contains *Nagasaki*. Trumpet and trombone parts are very well reproduced and the whole recording is excellent (F161).

Going over to a different type of record, we find the Orchestra Mascotte playing *Twinkling Lights* and *The Last Letter* (R2081). Another success from the recording point of view, and a record that will be popular. It is, as the one above, a Parlophone.

* * *

As I write this I am listening to the king of brass playing *The Girl with the Dreamy Eyes*. Yes, it's Jack Hylton and His Boys on H.M.V. BD164. It is a fine record and the orchestration is such that only Jack could give it full justice and still keep the snap in the rhythm. On the other side he is in more subtle mood with fiddles instead of brass to begin with, followed by the vocal refrain, then a little brass and a soft finale. The number? *Orchids to My Lady*.

* * *

Two more of Parlophone before I pass on. One is by Harry Roy and His Orchestra playing *On the Night of June the Third* and *Jubilation Rag*. All I need say about this is that it is Harry Roy at his best, and that praises both the band and the record (F158).

WELL DONE, PAT

Do you remember Pat Hyde as one of the Dancing Daughters? If I am not mistaken it is the same little lady who is entertaining us on Parlophone F173, where she and Her Swing Music give us *My Dance* and *Seein' is Believin'*. I like her and I like her music. Well done, Pat, let us have some more.

* * *

Next on my programme as I am listening and writing is a new arrival, Hildegarde. You probably heard her on the radio a short time ago—the girl with something of the Greta Keller type of microphone style, though not so intimate, but with an astonishing amount of personality. Her record does not seem to get over quite so well as her radio

(*Continued on page* 414.)

The handsome Walnut finished cabinet which has room for the necessary batteries.

VARIABLE-MU H.F. PENTODE IN H.F. STAGE

•

H.F. PENTODE DETECTOR

•

SUPER - SELECTIVE IRON-CORED COILS

•

CLASS 'B' OUTPUT

•

MOVING COIL SPEAKER

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Please send me free of charge, literature giving full particulars of the new Cossor 'Super-Ferrodyne' Receiver with Class 'B' Output, Model 436B.

L.152

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P.W. 22/6/35.

7048

THE NEW TELEVISION SERVICE

Details of the location of the television transmitter and the systems to be employed, together with a statement with regard to the Marconi-E.M.I. apparatus.

THE lack of developments during the last few months in connection with high-definition television transmissions has proved rather disappointing to all of us who are television enthusiasts; and in consequence the following information which we have received will be read with considerable interest.

The Postmaster-General announces that he has received a communication from the Television Advisory Committee regarding the choice of a site for the projected London Television Station and other matters relative to the proposed experimental television service.

After having carefully considered a number of possible sites, the Committee have recommended the adoption of the Alexandra Palace for the station. This recommendation has been approved by the Postmaster-General, and the British Broadcasting Corporation have made arrangements with the Alexandra Palace Trustees for the use of a portion of the Palace buildings for the station.

The ground at the Alexandra Palace is 306 ft. above sea level; and it is proposed to erect a 300-ft. mast on the site, thus providing an aerial height of 606 ft. above sea level, which, it is considered, should enable a high-definition television service to be provided for the London area.

Two Systems Proposed.

As recommended in the Television Committee's Report, the Baird Television Company and the Marconi-E.M.I. Television Company are being invited to tender for the supply of the necessary apparatus for the operation of their respective systems at the London station.

The Baird Company propose for their system the adoption of a standard of picture definition of 240 lines sequential scanning, 25 picture traversals per second, 25 complete frames per second; and the Marconi-E.M.I. Company propose for their system a standard of 405 lines, 25 pictures per second, interlaced to give 50 frames per second, each of 202½ lines. Subject to satisfactory tenders being received, the Advisory Committee recommend the adoption of these standards for a public service during the trial period. Whilst it is contemplated that each system will be operated mainly on the standard proposed for it by the relative company, the alternative standard may be employed by permission of the Advisory Committee with either system. In such event due public notice would be given of the change.

The committee have satisfied themselves that receivers can be constructed capable of receiving both sets of transmissions without unduly complicated or expensive adjustment.

The committee propose that the vision signals should be radiated on a wavelength of about 6·6 metres and the associated sound signals on a wavelength of about 7·2 metres.

If the tenders submitted by the two companies are accepted, such technical information regarding the characteristics of the television signals radiated by the two systems as will facilitate the designing of television receivers capable of picking up those signals will be made available to manufacturers by the respective companies.

The E.M.I. Statement.

A high official of E.M.I., interviewed in connection with the announcement of the Television Advisory Committee, made the following statement with regard to the Marconi-E.M.I. system:

"The principal objects in recent television development have been:

1. To produce a picture of the highest definition possible.
2. To avoid flicker, which, as everyone remembers, was a very serious defect in cinematography years ago.

"In the system which the B.B.C. has been broadcasting for the last few years, 30-line pictures at 12½ per second were the best that could be obtained. This was only a preliminary step, and with the advent of high definition television this service will be discontinued.

Experimental Transmissions From Hayes.

"In Germany a system has been inaugurated transmitting 180-line pictures at 25 pictures per second, but the report by the Television Commission wisely insisted on a minimum of 240 lines, 25 pictures per second, for this country.

The research engineers of the Marconi-E.M.I. Television Company, Ltd., have for some months past been sending experimental broadcasts from Hayes to receiving stations in London using 405 lines, and have eliminated flicker by their method of 'interlaced' scanning. The result of this development is:

1. That with 405 lines the definition is adequate for all types of picture, either as seen at a cinema or picked up from real life, and
2. Due to the method of interlaced scanning, the transmission is equivalent to 50 pictures per second, and therefore flicker, which is so fatiguing to the eye, is entirely absent.

"The receiver which will be required for these 405 lines interlaced pictures will not in any way be more costly or more complex than one for the minimum of lines and pictures recommended by the Commission.

(*Continued on page* 416.)

HOW THE WHOLE OF LONDON WILL BE SERVED

This map, with Alexandra Palace, the site of the new television transmitter, as its centre, shows the places which fall within the expected service area. It is not unlikely, however, that many places outside the circle will obtain satisfactory reception.

For OBVIOUS REASONS

For obvious reasons this is the time for you to invest in a new radio. There are weeks of unique broadcast programmes ahead, and during the next few years superheterodyne radio of the modern type is going to be more and more necessary for perfect separation and reproduction of Europe's elaborate network of programmes.

For obvious reasons also, a Marconiphone is the instrument you should have. *It is the only radio which needs no introduction, no explanation and no justification.* Its unique superiority in home entertainment, with 25 years lead of all others, is obvious the moment you compare it with any other instrument. You will never be really satisfied until you have a Marconiphone. Why not use the coupon below and secure your instrument in time for the many brilliant programmes? Post it now and we will send you a fully descriptive leaflet and place you in touch with your 'Local Marconi-men' upon whom you can rely for prompt and experienced service.

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The model illustrated is the

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A 5-valve 7-stage instrument of very latest design and the keenest possible performance. (Model 287 for A.C. mains).

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APPLY NOW *for an illustrated descriptive list of the Marconi Jubilee Year Models and the address of your local Marconi-men.*

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ON THE SHORT WAVES

SOME PRACTICAL POINTERS

Dealing with large aerials and making an efficient H.F. choke are items included in this article by W. L. S.

FROM my weekly post it is obvious that there is a tremendous boom in short-wave reception at the moment, and that I am addressing a larger and larger percentage of novices each week. The said novices have been letting me know, recently, that I am not giving them a fair deal; and as soon as I *do*, there will be an outcry from the "old hands," who ask me to cut out the "Kiddies' Korner" stuff!

This week I'm going to be clever. I'm going to give the novices some practical tips for themselves, but I rather imagine that some of the "old 'uns" will possibly profit by them as well.

Attention to Detail.

Success in short-wave reception is almost entirely a matter of attending to detail. The funny part of it is that even the folk who *know* this usually fail to put their knowledge into practice. How many sets, I wonder, have I seen spoilt by little displays of carelessness here and there?

Very well, then; let's be practical for a bit. And let us also be logical and start with the left-hand end of the circuit diagram. What sort of aerial are you using, and how are you coupling it?

If it's your ordinary broadcast aerial, it will probably be at least sixty feet long, and will need coupling quite loosely for the short waves. But is it a *good* aerial? Keep the lead-in away from the metal gutters, and from the wall and window sills. Similarly, keep the far end away from the mast or tree.

The farther your aerial wire is from everything around it, the better off will you be. The ideal short-wave aerial is one with a very small capacity to earth.

Now for the coupling. If you use some of the popular four-pin coils that are on the market to-day, you will probably have to use capacity-coupling. If you use a pre-set condenser, *don't* screw it down until something goes pop. Rather try to operate it with the adjusting knob as far out as possible.

Grid Circuit Considerations.

Better still, use a baseboard-mounting neutralising condenser, or make your own condenser with four or five inches of twisted insulated wire.

Next along the route comes the grid circuit itself—assuming, that is, that we are dealing with a set without H.F., as we are at the moment. The grid circuit consists of the grid coil and the condenser that tunes it, and it should be a *circuit*—not a maze! The condenser must be directly connected across the coil with two short, clean, stiff bits of wire. The grid end of it should preferably attach itself to the grid terminal on the valve-holder by means of the grid condenser alone; no wiring is necessary if you plan out the position of the parts nicely.

The earth-return is just as important as the grid end, and it should go to earth as directly as possible. If you use a metal or metallised front panel, the condenser has already looked after this for you. If you don't, connect the moving plates of the condenser either to your foil-covered baseboard or to a wire running directly to the negative filament terminal of the valve holder.

The same applies, in lesser degree, to the reaction circuit. I'm purposely avoiding diagrams for this, since I want these remarks to apply to *your* receiver, whatever circuit it uses.

The anode terminal of the valve holder should be connected as directly as possible to the appropriate terminal on the coil-holder. This, of course, should be the end of the reaction coil that is farthest from the grid coil.

The other end will probably go to the reaction condenser and through a choke to H.T. This choke is worth talking about.

If you use a series-fed circuit the choke will be in the position I have mentioned—between the "dead" end of the reaction coil and H.T. In a parallel-fed circuit it will go straight to the anode. In a series-fed circuit the choke is relatively unimportant; in a parallel-fed its efficiency means everything.

The object of a choke is to present a very high impedance to high-frequency currents that are meant to go by some other route. If they trickle away through the choke they may get into the L.F. stage or simply be wasted away through the H.T. battery.

A tuned circuit presents a high impedance to H.F. currents of the particular frequency to which it is tuned. A choke, generally speaking, has a resonant frequency of its own, but obstructs all higher frequencies than that.

An Easily Made Choke.

If your short-waver has to work right up to 80 metres, then you will want a choke with a resonant frequency of about 3,000 kc., corresponding to 100 metres. Many short-wave sets do not work well on the "top band" owing to the use of too small a choke.

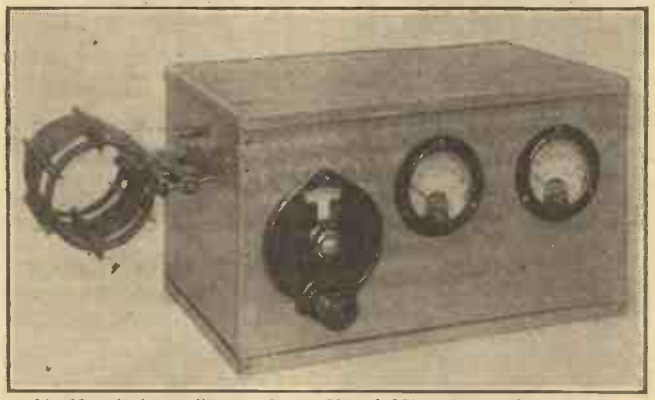
An easily made and efficient choke consists of 60 turns of wire on a half-inch ebonite rod or tube. The wire may be "close-wound"—it is difficult to space the turns and make a neat job of it. Regarding gauge of wire, all that I can suggest is that you use what you have by you. Anything between No. 24 and No. 36 is suitable, finer wire having its special applications for flat-tuning chokes for other purposes.

My next tip will probably make some of the old-stagers laugh heartily. I am actually going to suggest that the use of some form of filament-voltage control is often useful. If you happen, as I do, to have some old filament rheostats for which you paid fabulous prices a few years ago, wire one in series with your detector filament and play with it for a bit. Many cases of bad reaction control have been traced to valves that prefer 1·7 volts to the full 2 volts.

Continuously Variable Control.

H.T. control by means of a variable resistance of about 50,000 ohms is also a refinement that may well be incorporated in a short-waver. I am not necessarily advising you to control reaction by this means (although it can be excellently done with a good resistance); but it is nice to have a continuously variable voltage.

A COMPACT TRANSMITTER



This 10-watt transmitter works on 80 and 160 metres, and was used for National Field Day, June 1st–2nd, by the South London district of the R.S.G.B. The meters read the anode currents of the crystal-oscillator and power-amplifier.

NOVA consolette.

An A.C. superhet, of entirely new design, contained in a beautiful bakelite cabinet either jet black or walnut brown finish with ivory inlay. Has a powerful 2½-watt pentode output, Ferranti Moving-Coil Speaker, one knob tuning, continuously variable tone control, Automatic Volume Control, illuminated "All-in" dial with station names and wavelengths, and visual indicators for waveband, volume and tone. Terminals for extra speaker, cut-out switch for internal speaker, provision for gramophone pick-up. Mains aerial. Dimensions: 17¾ in. high x 13 in. wide x 8¾ in. deep. **Price 11 Gns.** Or on deferred terms: Deposit 25/- and 12 monthly payments of 19/-.

LANCASTRIA consolette.

A superheterodyne receiver with a similar technical specification to the "Nova," but fitted with the additional refinement of electric tuning, noise suppressor (Q.A.V.C.) and provided with a wood cabinet tastefully finished with veneers of walnut, Australian silky oak and macassar ebony. Dimensions: 18⅛ in. high x 14 in. wide x 9⅛ in. deep. **Price 12½ Gns.** Or on deferred terms: Deposit 27/6, and 12 monthly payments of 21/7.

LANCASTRIA Universal A.C./D.C. model

Performance as above, but no gramophone pick-up, terminals or mains aerials. **Price 13½ Gns.** Or on deferred terms: Deposit 33/6 and 12 monthly payments of 23/-.

ARCADIA consolette.

This A.C. Superhet is superlative both technically and artistically. Selectivity of the highest order, 2½-watt triode output, high-note uplift, continuously variable tone-control, Ferranti Moving-Coil Speaker, Q.A.V.C. and electric tuning, ensure first-class reproduction. All-in dial with station names and wavelengths and indicators for waveband, volume and tone. Mains aerial, terminals for extra speaker, cut-out switch for internal speaker, Ferranti valves and provision for gramophone pick-up are included. Beautifully finished cabinet, in walnut and macassar ebony, with sycamore decoration.

Dimensions 18⅞ in. high x 14½ in. wide x 9⅛ in. deep. **Price 15 Gns.** Or on deferred terms: Deposit 35/-, and 12 monthly payments of 25/8.

UNA consolette.

An A.C. receiver incorporating a Rectifier, H.F. Stage, Detector, and powerful 2½-watt Pentode Output. Ferranti Moving-Coil Speaker and illuminated "All-in" dial with station names and wavelengths. Provided with attractive horizontal cabinet with walnut veneer, this set is capable of first-class reproduction and good performance, and will meet fully those cases where superheterodyne selectivity is not required. Dimensions: 12 in. high x 19¾ in. long x 9 in. deep. **Price 8½ Gns.** Deferred terms: Deposit 18/6, and 12 monthly payments of 15/-. Universal A.C./D.C. Model. Similar specification and same price.

ARCADIA radiogram.

This incorporates all the features of the Arcadia Consolette. High grade electric gramophone motor and pick-up. Tone Control and Scratch Filter are provided, as well as a combined Gramophone and Noise Suppressor switch.
A combined Radio and Gramophone Volume Control and On-off switch is mounted on the front of the Cabinet.
Dimensions: 32 in. high x 30 in. wide x 16 in. deep. **Price 26 Gns.** Or on Deferred Terms: Deposit 56/- and 12 monthly payments of 45/-.

ARCADIA console.

A receiver having a similar specification to the Arcadia Consolette, but with much larger cabinet, making it an attractive piece of furniture. Dimensions: 32 in. high x 17 in. wide x 10½ in. deep. **Price 18 Gns.** Or on deferred terms: Deposit 38/- and 12 monthly payments of 31/2.

GLORIA radiogram.

A superb radiogramophone with all the features of the Arcadia Consolette, and in addition a super-powerful 6-watt push-pull output stage, capable of very nearly perfect reproduction. Dimensions: 34 in. high x 33 in. wide x 17⅛ in. deep. **Price 45 Gns.** Or on deferred terms: Deposit 95/- and 12 monthly payments of 78/-.

GLORIA autogram.

Specification as above, but with automatic record changer, suitable for all makes of records. **Price 52 Gns.** Or on deferred terms: Deposit 112/- and 12 monthly payments of 89/10.
Alternative payments can be arranged over a period of 18 months for all these models.

FERRANTI

masters of power

FERRANTI, LTD., RADIO WORKS, MOSTON, MANCHESTER, 10.

ON THE SHORT WAVES—*Page 2.*

Points from the POST-BAG

P. N. N. (Loughborough) asks a good many queries, which I will try to cover in one go. He explains, at the outset, that he doesn't go in for loose and "wobbly" parts, and that his bench isn't covered with junk. Despite all this, he gets far too much background noise.

A Perpetual "Fizz."

With the single-valver he was never troubled, but now he uses an L.F. stage he gets a perpetual "little fizz" which puts him right off his stroke. It isn't transformer, resistance, condenser, H.T., grid-bias, or valves, he says! Well, P. N. N., you may be getting an overall "mag." of 20 or 30 with your L.F. stage, and a certain amount of hiss is inevitable. You don't say whether it only occurs when the detector is oscillating.

Next, P. N. N. got down to it on the lines I suggested for killing hand-capacity. Eventually he did, by loosening aerial coupling; but now he finds signals are no stronger with the aerial than without! Try a different length of aerial, and you will be able to increase the coupling without bringing the trouble back.

Finally, your Z H C, heard in commercial Morse transmissions, means "I am receiving you well," or, if with a query, "Are you receiving me well?"

K. B. (Bournemouth) wants identification of sundry stations. Here are a few of them: W Y W, W I A, W P B—all U.S.A.; J N D, Tokio; T D S, don't know, but should like to! "Santo Domingo, Dominican Republic" should find H I V all right. Re the Q S L card—yes, I think you've got all the essentials on it.

F. W. (Plymouth) agrees with my recent remarks on the need for better selectivity, and comments on the wonderful "hash" in the 31-metre band when all the high-powered stations are on together. He also asks whether it is usual for a 120-volt battery, run down to 85 or 90 volts, to produce threshold howl. I wouldn't say it is *usual*, F. W., but the chances are certainly in favour of a howl.

What Station Is It?

T. D. (Kentish Town) wants to know if anyone can identify a station close in wavelength to W 2 X A D (19·56 metres). This station announces in English (not American), seems to work only on Tuesday mornings, and the programme consists of records of "hot" dance-music. It doesn't sound like our sedate Empire station, but I certainly can't place it.

T. D., whose full address is T. Delvin, The Carlton Tavern, Carlton Road, Kentish Town, wants to make the acquaintance of other short-wave fans in the neighbourhood, and would also like to hear of a local society in that part of the world. He is an inveterate sufferer from hand-capacity and would like to share his troubles with someone sympathetic.

A. W. O. (Caernarvon) proposes to build "The Mighty Atom" ("P.W.," September 15th, and December 1st, 1934) and shoots with some preliminary queries. First, can he use an ordinary insulated connecting wire of the "Glazite" type for the coils. Yes, A. W. O., it's excellent, and there's no need to remove the insulation.

Secondly, he suggests that a good aerial-series condenser might be made from some old variable-condenser plates. I imagine that two fixed and one moving, double-spaced, would be excellent. Thirdly, he wants my opinion on flattened galvanised-iron sheeting for "earth returns." Don't like the sound of it, A. W. O., but try it.

L. S. T. (Sidcup) wants to convert an ordinary triode-and-L.F. set to work with a screened-grid detector. Easy, L. S. T.; look up your "P.W." for October 20th, 1934. Your coil queries were covered in my article a fortnight ago. Your other one merits a special mention, though. Readers, listen to this:

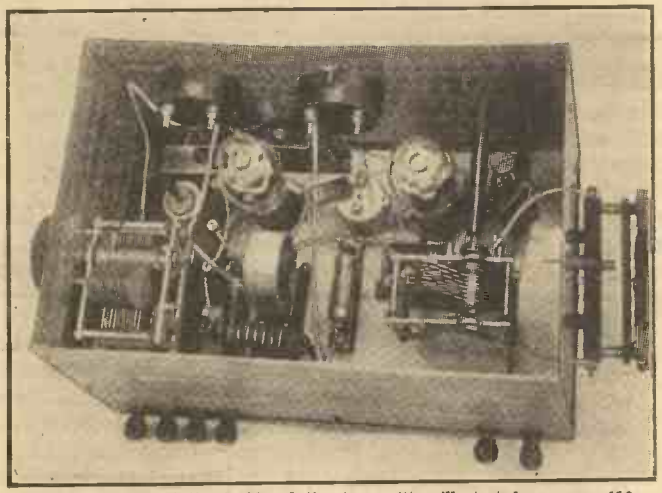
L. S. T. gets Moscow on 28 degrees when he uses a 6-turn coil on a 2-in. "Paxolin" former mounted horizontally. With the same number of turns on a vertical 2-in. ebonite former, Moscow comes in at 64 degrees! Is it the dielectric material or the plane of mounting? I can only suggest that he tries the "Paxolin" vertically and the ebonite horizontally.

H. C. L. (Chester) has logged Z F B on about 16 metres calling London, and suggests that it solves R. J. B.'s query about a station saying, "Hullo London, Cape Town calling." Unfortunately, I believe Z F B is in Bermuda, but Z S B is certainly Cape Town. Did you mis-read it, H. C. L.?

Will "E. J. E." (Ipswich) please introduce himself to "G. W. G." of the same town? His address is G. W. Green, 17, Jefferies Road. Thank you.

"F. V. E." (Tottenham) sends in a voluminous log of amateurs received during the last three months. I am filing it for comparison with similar logs sent in by others.

THE INTERNAL ARRANGEMENT



Here is a view of the inside of the transmitter illustrated on page 410. To the left, towards the top, can be seen the crystal-holder with the crystal-oscillator valve nearby. Standard receiving components are used throughout.

SHORT-WAVE NEWS

THE B.B.C. announces that the Royal Review of the R.A.F. will be broadcast in all the Empire transmissions on July 6th and 7th. This review takes the form of an inspection on the aerodrome at Mildenhall, and, later, a "fly-past" at Duxford aerodrome. Squadron-Leader Helmore will be the commentator.

Special Dominion Day programmes for Canada on July 1st are also announced.

New Members Welcomed.

The secretary of the Tottenham Short-Wave Club asks me to bring the club to the notice of readers. A full autumn programme is in course of preparation, and new members will be welcomed if they will apply to the secretary at 57, Pembury Road, Tottenham, N.17.

The Glasgow and District Radio Club has been carrying out 5-metre tests from Ben Lomond, and has become very enthusiastic over ultra-short-wave work. Readers across the Border who would like to meet fellow-spirits are asked to make themselves known to Mr. J. Hair, 42, Maryland Drive, Glasgow, S.W.2.

(No, Mr. Hair, my name isn't Wilkins; nothing so obvious as that!)

The R. S. G. B.'s National Field Day is well behind us, and, as usual, it was a very successful event. I am still trying to collect my impressions of our own station, which includes chasing quite a number of people who took photographs of some of us in unconventional attitudes, and duly suppressing them.

I hope to tell you the full story quite soon, when I am *quite* sure that none of them will leak out!

Before the summer is over I gather that a big 5-metre Field Day is being arranged. Five-metres, of course, is so eminently suited to portable work that it is much less trouble than the top bands, on which we worked on June 1st–2nd. Watch these columns, you owners of 5-metre receivers—you'll probably be wanted!

Excellent Reception Conditions.

Conditions up to the time of writing have been amazingly good. The 19-metre stations have been almost unbelievably strong and reliable during the evenings, especially "Old Faithful," W 2 X A D. Night after night I have switched on a few minutes before 8 p.m. and found his carrier-wave all ready. At 8 p.m. exactly an R 9 voice out of the speaker (on two valves, only) announces that the G. E. C. station is about to commence its stuff.

For the whole hour he is usually as steady and reliable as the average local station.

W. L. S.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return M S S. not accepted for publication. A stamped, addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

ECONOMICAL CLASS B OPERATION.

A. M. (Weston-super-Mare).—"Can you help me to find the cause of distortion on my Class B Four (S.G., Det., Driver and Class B)?

"With the idea of keeping battery consumption down to the very minimum I have been experimenting a bit, and so far as total consumption goes I have got the drain on the batteries down very satisfactorily. But the quality seems to have fallen off a bit.

"One of my stunts is to over-bias the driver valve, and I have been wondering if this would affect quality? Is there any way of telling how far one can safely go in this direction without affecting purity of reproduction?

"I understand that a milliammeter test for distortion is no good with Class B, but is there any other way I can find out whether the trouble is in the driver stage? The distortion is only on certain (infrequent) passages, so it is not easy to say from merely trying different voltages, etc., and if you can put me on to a definite test I shall be very pleased."

If the distortion is primarily due to the over-biasing of the driver valve it should be possible to detect the effect by inserting a milliammeter in its plate circuit, in the same way that is done for detecting distortion in an ordinary triode output valve.

The separate driver valve of a Class B stage can be considered as a small output valve so far as its plate-current wave-form is concerned, and if excessive bias is used for this valve there will be the usual "upward kicks" on the needle of a sensitive milliammeter in the plate circuit, due to the increase in average anode current when large grid swings are being handled by the valve.

Readjustment of the bias with the milliammeter in circuit as a check should enable you to find an economical setting that does not introduce distortion.

HOW TO FIT AN OUTPUT FILTER TO THE MODERNISED "MAGIC."

T. F. (East Grinstead).—"I want to fit a simple output filter consisting of choke and condenser to the modernised 'Magic,' as shown in POPULAR WIRELESS dated 4th May, 1935.

"From the diagram on page 228 I see that the H.T. from the + 3 lead goes to the anode terminal of the valve holder via the loudspeaker. Now I want to use two loudspeakers, either of which I can cut out by a switch across it. And as one of them is on the other side of the house I do not want H.T. running all over the house.

"I have an output choke of 30 henries. What condenser should I use with this, and what will the alterations consist of?"

Thirty henries is a suitable value for the choke. The filter is best made into a small unit consisting of the choke with condenser mounted beside it, and a pair of "L.S." terminals. Two or four microfarads is a suitable value for the condenser, one terminal of which should be permanently wired to one terminal of the choke.

This junction between choke and condenser must be connected by a short lead to the L.S.— terminal on the set; the one which goes to the terminal marked A, on the valve holder.

The other side of the choke—that is, the terminal that is *not* connected to the new condenser—is joined to the set's L.S.+ terminal by a short lead. It thus provides the necessary connection to the H.T.+3 lead, since this lead is left connected to the inside of the L.S.+ terminal.

You still have a vacant terminal on the new condenser. This should be wired to the nearer L.S. terminal on the filter unit. Finally, the remaining L.S. terminal on the filter unit is wired to the set's earth terminal. This completes the alterations.

The pair of leads to the loudspeakers will, in future, be connected to the L.S. terminals on the unit, instead of to those on the set, as before. You will, however, have the advantage that no H.T. current will pass through the loudspeaker windings, and the long extension leads can, therefore, be taken off with impunity.

Another advantage of filtering the output by means of the choke and condenser is that the operation is freed from the possibility of unwanted couplings which might otherwise be present; and since there are still further advantages we think you are doing very wisely in providing a filter in this way.

"DOES A.V.C. MAKE FOR TOO MUCH UNIFORMITY?"

G. B. (Southampton).—"To my mind one of the great essentials of life-like reproduction is to get the big contrasts between the soft and loud passages—that soft swing of the violin, followed by the crash of the orchestral movement, giving the light and shade effect so noticeable at the concert and so rare from the loudspeaker.

"Now, as I understand automatic volume control, it succeeds in levelling up the programme. While that may be an advantage from one point of view, does it not destroy quality by removing contrast?

"We already have the B.B.C. control man doctoring the loud passages to suit the transmission. Would not the effect of automatic volume control be to give further uniformity, i.e. less contrast, and consequently less fidelity to the original?"

What Actually Happens.

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THE LINK BETWEEN

By G. T. KELSEY.

THIS being the annual set-buyers' opportunity number of "P.W.," it is fitting that I should have a few words to say under this heading concerning the purchase of sets over an extended period. Speaking personally, and with perhaps one or two reservations, I am all in favour of it.

Most of us are ambitious in our ideas of what constitutes the ideal radio set, and were it not for the very generous hire purchase facilities which are now almost universally available I am afraid that not all of us would be able to realise those ambitions. But when it is possible to get such outstanding sets as are described on other pages of this issue for a matter of only a few shillings a week—well, who wouldn't be in favour of the credit system of buying?

That there are pitfalls for the unwary I am quite prepared to admit, for I always have thought that the secret of successful credit buying, in so far as radio is concerned, lies in being able within reason to anticipate the future. But in this case "P.W." has done that for you!

The sets which have been selected for inclusion in this number have been chosen because they are likely to be in keeping with modern requirements, not only for the period over which the monthly payments are made, but for many years to come. You can, therefore, contemplate the hire purchase of any one of these fine sets with complete confidence as to the future.

Make a Job of it!

While on the subject of complete sets I feel that I should be lacking in my duty if I failed to make reference also in this special issue to the immense advantages of having an extension speaker. I have always been of the opinion that such a refinement doubles, and even trebles, the usefulness of a set, and for the slight extra expenditure incurred it is a proposition that is worthy of serious consideration.

But I wonder how many listeners are aware of the ease with which an extension speaker can be fitted? Indeed, I wonder how many are even aware that such an addition is possible? If I am not mistaken, not nearly as many as might be. And yet there are very few sets these days which are not provided with the necessary terminals or sockets.

As a matter of fact, the fitting part is child's play, since it is only necessary to connect the speaker to one end of the extension wires, and the other end of the extension wires to the terminals so marked on the set. But the great point is first to choose the right type of speaker.

Don't imagine for one moment that any kind of speaker will do.—It certainly will not. The output arrangements of sets vary so enormously that it is imperative to use a speaker the impedance of which can be matched up to suit your own particular requirements. And what could be more eminently suitable than the W.B. "Stentorian"?

I hand them the laurels because they happen to be in the singularly fortunate position of having the right article to offer at the right price.

For instance, the standard "Stentorian" speaker, which can instantly be matched up to any output arrangement, can be bought for 44s. 6d. complete with cabinet, while the chassis only is available for 32s. 6d. And you will all be sufficiently familiar with the reputation of W.B. to know that the quality of reproduction given by these speakers is second to none.

Who wouldn't plump for radio in every room under these conditions?

Good-bye to Noise!

I have just received from Messrs. Belling & Lee, Ltd., a copy of their latest manual on interference suppression, and in my opinion it is one of the finest, if not *the* finest, treatise on the subject that has ever been published.

From cover to cover it is literally packed with information concerning the elimination and suppression of every conceivable type of electrical interference, and it is evident throughout of the vast amount of research that this enterprising firm has undertaken in the great cause of noise-free radio reception.

The menace of "man-made" static these days is a very real one, and until such times as legislation is introduced to deal with the problem on a country-wide basis, the nuisance is hardly likely to abate. Thus, for the trojan service that they are rendering to the listening community, I do feel that Belling & Lee are deserving of every congratulation.

The comprehensive manual that they have produced costs one shilling, and, in my opinion, it is worth every penny of it. If you are enduring any form of interference trouble, take my tip and send for a copy right away while the going is good, for you can rest assured that therein you will find a chapter applicable to your particular case. Address your applications—and don't forget your "bobs"—to Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

ROUND THE RECORDS

(*Continued from page* 406.)

performance, but it is good nevertheless, and Columbia are to be congratulated on obtaining another star. The record is *I Believe in Miracles*, on Columbia DB1552. The other side is *Listen to the German Band*, quite a different style of number. I prefer Hildegarde in the crooning rôle. Whatever she is singing, however, her diction is perfect.

* * *

The Masqueraders have made another record in the neat style for which they are famous. It is *The House Where I was Born*. Columbia still hold these performers, and the number is FB1062. On the other side is *The Paper Hat Brigade*.

* * *

One of the most popular of the operas is Saint-Saens' "Samson and Delilah," and out of this probably the best known aria is the duet *Softly Awakes My Heart*. It is a piece of music that never grows old, and Columbia have again given us a recording of it. This time it is in French and is unique in that the complete duet is recorded. It is sung by Mlle. G. Cernay and M. Georges Thill (Columbia LX385). Beautifully sung throughout, it is a record that I can thoroughly recommend.

* * *

Let us end on a different note. I have just heard RC2747, an H.M.V. record of the King's Jubilee speech, and on the other side a record of the crowds who welcomed their Majesties on their drive to St. Paul's on May 6th. It is a record that is historical to a degree, and if not for yourself, you should get it for the sake of the younger members of your family, whose memories of the great day may dim in future years. The proceeds of the sale of the record go to charities to be nominated by His Majesty. The record is a truly great one and should not be missed by anyone.

K. D. R.

ON THE AIR

(*Continued from page* 404.)

played with considerable feeling. Indeed, all the players did. "Liebelei" is a sad play, but the sadness was cleverly relieved by a number of haunting waltzes played on a piano.

* * *

I wonder whether Mr. John Moore had the drawing power of the man who succeeded him in the "Freedom" talks. I wonder whether listeners who listened to both talks were more impressed by the one than the other, or vice versa. Whatever the answers to these two questions, I am quite certain that Mr. Moore's talk was judged an impressive one. There was style in his narrative. Some of his sentences were finely constructed. I always marvel at this type of man who, in spite of that inevitable lack of opportunity that Mr. Moore spoke about, can so educate himself as to be able publicly to hold forth as an authority on subjects outside his own sphere of work. Mr. Moore did this, and sincerely, too, although he dealt with only one aspect (a vital one, all the same) of that vast subject "Freedom."

* * *

"Fifty to One" was not a good story. It was no better than, if as good as, scores of short stories that appear in print every week and month. But A. J. Alan reading it made it appear good. A. J. A. is an unique story-teller, and whatever his story, good or bad, I could listen to and enjoy him any old time.

C. B.

THE "B.C.L." TWO

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to thank "P.W." and "W. L. S" for such a fine set as the "B.C.L." Two. I have had plenty of short-wave sets in my time, but for all-round work give me the "B.C.L." I am just writing this letter to let you know how I am going on with it.

Here are the stations I have got during the time I have had the set:

VK2ME, VE9GW, LKJ1, FYA, RW59, W3XAL, PRF5, DJB, DJC, W2X2, W8XK, GSB, W2XAD, GSA, W2XAF, CTIGO, EAG, 2RO, W1XAZ, PH1.

Wishing your paper every success,

Yours faithfully,

W. S.

Bradford, Yorkshire.

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Wireless and Television Review

SIXPENCE MONTHLY.

TECHNICAL JOTTINGS

Items of Interest to all Readers

By Dr. J. H. T. ROBERTS, F.Inst.P.

I SPOKE of non-inductive condensers a week or two back, and a reader asks me whether this means a mica condenser, or whether it is possible for any other type of condenser to be non-inductive.

I think this is a fairly common misunderstanding. The fact is that a mica condenser is non-inductive, but not simply *because* it is mica. The mica, being in flat sheets, necessitates the use of several layers of conductor and insulator, and this formation leads to a non-inductive condenser. But the same result—so far as non-inductive properties are concerned—would be just as well reached if, say, waxed paper were used instead of mica.

Paper condensers are generally used for larger capacities, and one common form of construction is to take long strips of paper and corresponding strips of tinfoil, and then proceed to wind up these strips into a roll, afterwards compressing the roll from the "round" shape into a suitable flat shape for insertion into a case or container. You can easily see that a formation like this will be inductive. But if each "turn" of the roll is connected together, then the inductive character is got rid of and the condenser becomes for practical purposes *non*-inductive.

Mica and Paper Condensers.

So you see, the question whether the condenser is inductive or non-inductive does not directly depend upon whether it is a paper or mica condenser. A mica condenser will be non-inductive, whilst a paper condenser *may* or may *not* be.

If you are using a condenser for a layout where a non-inductive condenser is specified by the designer of the circuit, it is very important to make sure that you get a really non-inductive one, as an ordinary one will give you unsatisfactory results.

Little Components Most Trouble.

I wonder why rheostats and switches give so much trouble in a wireless set? You would think that there was little to go wrong with a rheostat, and still less with a switch, and yet I'll guarantee that when anything *does* break down, or when scratching or crackling and all the rest of it occurs, it's ten to one that the fault is to be found in a switch or a variable resistance.

I don't know why it is, but some manufacturers don't seem to give the care and attention to these simple but essential components that they deserve. With a rheostat it is generally the slider arm that leaves contact with the resistance element at some point or makes such poor contact as to be even worse.

With a switch, very much the same kind of thing happens. I had a case in point only a few days ago. A beautiful set it was, and *when* it worked it worked well; but I think every component in that set that *could* make bad or doubtful contact *did* so. And the trouble was that it wasn't always the same one!

Getting the Chassis Out.

In the end I had the chassis right out and overhauled every one, whether under suspicion or not, and it was only that way I got it right.

It does seem a pity, when such care is given to the bigger and more expensive components, that the simpler but none the less important ones should be left to give such endless trouble. The strength of a chain, the proverb says, is no more than that of its weakest link, and I would like to commend this to the notice of some of the makers of switches and variable resistances.

Bass Response.

I daresay you have noticed how difficult it is to get any sort of bass response from a set when using an unsuitable low-frequency transformer. This is a well-known defect, and is generally due to the fact that there is not sufficient wire on the primary of the transformer—usually due to reasons of cheapness—and, consequently, the inductance is too low.

Primary Inductance.

If D.C. gets into the primary of the transformer, it will make matters worse, and, as a rule, D.C. *does* get in. One of the things you can do to improve matters, therefore, is to keep the D.C. out, and this can be done by putting a fixed condenser of, say, half-a-mircofarad between the primary terminal of the transformer, and the anode of the previous valve, the H.T. terminal being then connected to the negative end of the H.T. source, whilst the anode terminal of the condenser is connected to a suitable value of H.T. positive. It will be necessary to put a resistance in series with this H.T. positive connection; the value of the resistance will depend upon the impedance of the previous valve.

Have You a Keen Ear?

Different people differ very greatly in their perception of musical quality. Some people are quite satisfied—in fact, pleased—with a type of loudspeaker reproduction, for example, which to another person is full of faults and completely distasteful.

For reasons of this kind it is very difficult to lay down any hard-and-fast rules with regard to distortion. We may, however, say that in wireless reproduction there is always more or less distortion present, and the question is just how much distortion the owner of the set can stand.

Some people think that distortion only needs bothering about when speech begins to be unrecognisable or music harsh. But surely that is just about the limit of distortion. Conditions have to be very bad indeed for either of these two effects to be noticeable.

How to Cure Distortion.

Distortion often occurs, however, even in sets which their owners fondly believe to be

(*Continued on next page.*)

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TECHNICAL JOTTINGS

(Continued from previous page.)

perfectly respectable and well behaved. It may be that the distortion is not noticed until a friend with a critical ear happens to hear it. You may say then that it doesn't matter; but the curious thing is that when distortion is *cured*, even the uncritical ear notices the improvement. So, you see, it *is* worth while to try to cure distortion, even if it means a lot of trouble.

Many people think that when distortion occurs it is always the fault of the low-frequency amplifier. This is quite wrong. It is probably true that distortion is more frequently traceable to the L.F. amplifier than to the detector and H.F. parts of the set, but the latter can by no means be considered beyond suspicion. And when the distortion is due to the H.F. part of the circuit it is generally more difficult to trace it.

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H.F. Oscillation.

Usually distortion in the H.F. part is due to some form of oscillation, but the oscillation may not be evident by any howling or whistling. You may only notice the *suggestion* of a whistle when the set is just off-tune for a station.

As for the causes of this instability, it may be that the screening grid of the screen-grid valve, or H.F. pentode, is not getting its correct voltage, or the valve may be insufficiently biased for the conditions. Sometimes the H.F. amplifier is kept on the verge of oscillation when a variable-mu potentiometer control is used, if the control is set to the full-volume position. This may be due to inadequate screening.

The Slope of a Valve.

I think most amateurs nowadays understand something about the characteristics of a valve, but one of the particular points which seems to puzzle a good many is the "slope" characteristic. I am often asked by readers what exactly the "slope" means and in what way it forms a criterion of the suitability of a valve for some particular purpose.

The "slope" is a kind of short name for the property of the valve known more correctly as the "mutual conductance." It is arrived at by dividing a change in anode current by the corresponding change in grid volts, assuming a constant anode voltage.

For example, if we suppose that the anode of a valve has 150 volts constant voltage applied to it and the anode current changes from 30 milliamps at zero grid volts to 4 milliamps at minus 8 grid volts, then the slope (defined, of course, between these two limits only) will be equal to the change in the anode current—that is 26, divided by the change in grid volts—that is 8, the result being about 3¼ or, expressing it more fully, 3¼ milliamps per volt.

It is customary for manufacturers to specify the slope or mutual conductance of a valve at 100 volts H.T. and zero grid voltage.

Factors to Consider.

You will see from the foregoing why the term "slope" is used, because in a sense the ratio just mentioned gives an indication of the slope or "steepness" of the curve.

You will notice, from actual curves given in specifications usually supplied with valves, that the curves are actually "curved" so that the slope or steepness (indicated by the tangent to the curve at any point) varies from point to point. So it is not really correct to speak of the slope as being the same between two fairly widely separated points, as in the numerical illustrations I have taken above. However, it gives a fairly good general indication of the ratio within the limits defined.

What you really want to know for selecting a valve is that a valve with a steep slope—that is, a high mutual conductance—will give a high degree of amplification; but remember that the mere fact that a valve possesses a steep slope does not necessarily make it more suitable for a particular purpose than another valve with a less slope. There are various other valve characteristics to be taken into consideration.

Anyway, those of you who previously had any doubt as to what was meant by the "slope" of a valve will now, I think, have had the point cleared up.

THE NEW TELEVISION SERVICE

(Continued from page 408.)

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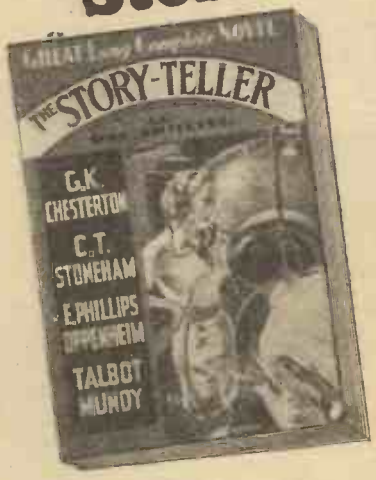

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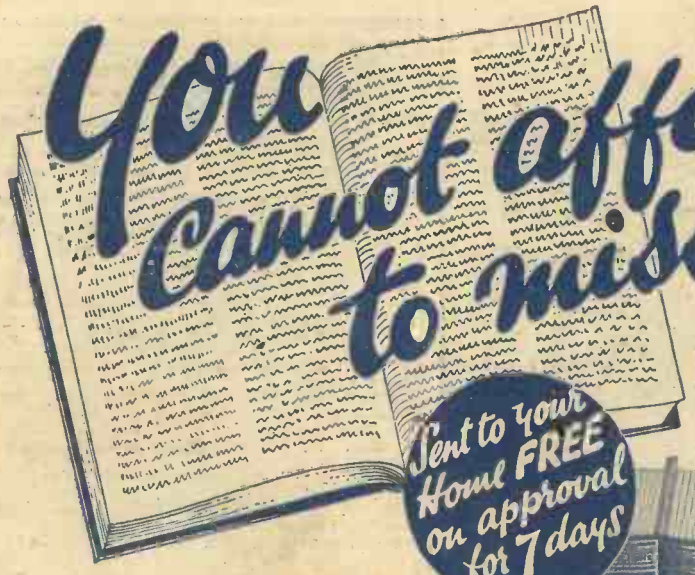

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POPULAR WIRELESS AND TELEVISION TIMES

MANAGING EDITOR: N. F. EDWARDS. TECHNICAL EDITOR: G. V. DOWDING, Associate I.E.E.

AN N.P.L. JOB
A NEW "DIAL"
HERR NIPKOW
A RADIO SHIP

RADIO NOTES & NEWS

SILENT SETS
DELHI'S STATION
IRON VALVES
HIDDEN GEAR

Transatlantic Results on 9 Metres.

WHEN "P.W.'s" historic experiment from the Crystal Palace disclosed that a range of 200 miles was attainable on the very short waves, certain lofty-domed scoffers suggested that such results were "impossible." Theory, they said, proved that wavelengths well below 10 metres could never reach such a distance.

I now ask these highbrows to look at Buenos Aires; for the Radio Research Board announce that they have received reports of Buenos Aires being received on 9 metres in this country.

Speaking without the map, I should say that Buenos Aires is about 7,000 miles away—a long, long trail, however the waves travel.

In the Air.

THE Air Ministry seems to be getting thoroughly radio-conscious at last, and I hear that the National Physical Laboratory is now being asked to undertake research directed towards radio "sign-posts" and "milestones" for safer flying. Beams are being laid to make radio "approach roads" to aerodromes, and a Vickers Viastra monoplane has been fitted with wireless apparatus to serve as an aerial laboratory.

Good news this. Uncle Sam tells a wonderful story of what radio can do to make aviation safe, and no nation runs so many night-flyers as the U.S. Since we pride ourselves on our fogs and our weather, it is up to us to evolve the corresponding counter-strokes.

Inventor's Corner.

TO the many inventions connected with tuning, report now adds the Globular Indicator, which ought to be a favourite with long-distance fiends and schoolmasters.

This device is said to take the form of a geographical globe, on which the world's wireless stations are marked by means of tiny lamps. If you want New York, or Nairobi, or other famous station, you spin the globe to bring that point under an indicator, and in doing so the set is tuned to the requisite wavelength.

I read that when this is done the appropriate lamp lights up, and the programme of the station in question pours forth from the loudspeaker.

News Miniatures.

BERLIN P.O. has opened four theatres showing television, free.

* * *

Among voice records in B.B.C.'s Gallery is Bleriot, describing pioneer Channel flight. * * *

ON OTHER PAGES

Americans Like Big Sets - - Page 425
Hughie Green and His "Gang" Page 426
Curing Vibration Effects - - Page 429
Handling "Dwarf" Waves - Page 433

The "Proms." begin Saturday, August 10th, and run eight weeks. (Forty-first summer season under Sir Henry Wood.)

* * *

Japan inaugurated regular overseas broadcasts June 1st. (Big "fan mail" expected.)

Leipzig's Improved Aerial.

LISTENERS to Leipzig (on 382·2 metres) who find that first-class station has recently been providing an anæmic programme should not jump to the conclusion that summer conditions have sneaked another victim. Leipzig's trouble is a temporary one, due to an operation. He has had his aerial cut down, and his kilowatt ration reduced for a time, while the engineers are busy on a new aerial.

This will be of the anti-fading type, now so popular in Germany. And it is expected that when the improvements are finished in August Leipzig's vocal powers will be enhanced, to the great gratification of listening aerials. So don't despise the little slice of waveband 'twixt the West and Scottish Regionals—Leipzig is only lying low.

Who Invented Television?

THE above question is asked in the rhetorical sense—beloved of schoolboys, because a rhetorical question requires no answer. (If only *all* the exam. questions were like that—eh, Smith minor?)

My object in asking who invented television is not to quench a thirst for information, but to remind you that this "young science"—this "latest gift of applied electricity"—is really not a new-born babe, but a hairy old half-centenarian. As long ago as 1885 Herr Nipkow, the German scientist, took out a scanning patent that doesn't look so very different from the modern specifications, so far as fundamentals are concerned.

Herr Nipkow's name has just recently been placed on a tablet in Berlin's Broadcasting House. He is now 75 years old, and in case he still reads the papers here's wishing him many happy returns.

A FAMOUS CONDUCTOR

Sir Thomas Beecham, the world-famous conductor, spends a few moments off duty listening to broadcasting. The receiver is a Marconiphone model "292."

Radio "Normandie."

WHEN I called the French liner "*Radio* Normandie" a few weeks ago I did not know the full extent to which she was qualified for that title. Later news of her wireless outfit confirms the notion that she is the biggest radio fan afloat.

Her three main transmitters work on short waves and on long, as well as the usual 600–800 metre waveband. There is a special give-and-take news installation on 8,000 and 20,000 metres, and eight short wavelengths for telephony.

Then there is a direction-finder radio compass, a "sounding" apparatus, and also various

(Continued on next page.)

THE UBIQUITOUS ULTRA-SHORT-WAVE GENERATOR

odds, ends, and make-weights. Even in mid-Atlantic the selectivity problem on board the "Normandie" is no joke.

A Cheerful Earful.

REPROACHES levelled at America's continually-bawling loudspeakers have caused one very bright boy to tackle the problem in a highly interesting manner.

He advocates the use of absolutely *silent sets!*

In the place of a loudspeaker the new system employs a sort of low-frequency magnetic loop, the "sounds" from which can only be "heard" by a tiny device fitted into the listener's ear. Other people, not so equipped, hear nothing, even when in the same room as the set. But the magnetic ear enables any wearer to wander all over the house and still remain within range of the set's programme.

Other Listeners' Ups and Downs.

AUSTRIA.—If the Austrian listener is caught listening for foreign propaganda stations he is liable to a fine of up to about £100 and to other deterrents.

* * *

U.S.A.—American listeners pay no licence fees, but the programmes are largely sponsored by advertisers, who mention their commodities more or less frequently.

* * *

NIGERIA.—A radio relay service is being started in Lagos, subscription five shillings a month, payable three months in advance. No local station, but programmes received from the Daventry Empire Station.

Cod Faces.

"IF you go to the average West-End theatre and study the faces of the audience, they look like a lot of cod on slabs." I came across that arresting phrase in the Exeter "Express and Echo"; and when I looked to see who spake those words I found, to my surprise, the name of Mr. Val Gielgud, the B.B.C.'s Drama Director.

He was addressing the local Rotary Club on Broadcasting and the Theatre, and he surely "let 'em have it," if this is a fair sample of his oratory. I'll bet the Rotarians enjoyed this off-duty plain speaking, for I have found them a clubbable crowd, with a liking for John Blunt talk.

India's Latest.

THE site for the wireless station to be built in New Delhi has now been selected, and those who know the neighbourhood may like to learn that it is close to the old town, on the Ambala Road.

Work is being begun forthwith, but at the time of writing it is undecided what wavelength will be used for New Delhi.

The power (20 kilowatts in the aerial) is sufficient for a big range in India's uncrowded ether, and it is hoped to get the first tests going by the end of October.

BROADCASTING BREVITIES

Bryan Michie has two interesting light programmes during July. Appreciations received after the broadcast of his first "Variety of Music" were so encouraging that a second date has been allotted to this form of entertainment. For the benefit of those listeners who did not hear this programme, "Variety of Music" consists of short turns by a succession of artists which vary from ultra-classical pieces to barrel organ music, with little interruption except for the purpose of the compère emphasising the variety.

Act follows act in quick succession, giving as far as possible the greatest contrast. One of the attractive features of these programmes is that there is something for everyone, and as turns are carried out by outstanding radio artists, each has its own attraction, and the merit of each performance adds to the variety of music which is the object of the programme.

* * *

Carroll Gibbons and his Boy Friends will broadcast on July 1st and not on July 21st, as previously announced. Carroll Gibbons and his Boy Friends are a well-known gramophone combination, but this will be their first broadcast. They feature pianoforte arrangements and what might be termed high-class dance tunes.

Those listeners who are interested in the development of this type of music should note this date and, furthermore, that the programme is presented by Austen Croom-Johnson, who is well known for his "Soft Lights and Sweet Music" programmes.

* * *

Homage to the King in his Silver Jubilee year is to be the keynote of the Northern Command Searchlight Tattoo, a part of which will be relayed for Midland listeners from Wollaton Park, Nottingham, on July 6th. There will be about 4,000 troops in the camp, and all of these, except about 500 who will be required for administrative purposes, will take part in the Tattoo.

The producer is Captain H. Oakes-Jones, M.B.E., F.S.A., and the Commentator Major F. C. Williams, M.C. A special hut is being erected for them and for the B.B.C. gear. Nine microphones will be used.

Versatility.

ONE of the well-known religious journals has ventured into reporting radio news. It states that "Farming machines for producing ultra-short electric waves of high-frequency power are now being commercially made in America. . . . The machines will be used to destroy insect pests, to sterilise milk and meat, dry timber, purge soil, and stimulate the growth of chickens."

Why this niggardly restriction to a few limited activities, I wonder? Why not ginger the machines up and make them separate the cream, pat the butter, germinate underground crops, purify wells, close gates, and call the men to dinner?

London's Television Station.

THE official statement that London's first public television station is to be at Alexandra Palace, N., has caused a flutter in Fleet Street. So many good sub-editors have had their hairs greyed by the technicalities of wireless that the more complicated mysteries of television are looked on with a loathing that night telegrams in Sanskrit do not evoke.

One unfortunate scribe has already fallen into a television trap. He reported that a 300-ft. mast was to be used, on ground 306 ft. above sea-level, and the total 606 ft. would give the new service the necessary *high* definition!

Butterfingers' Delight.

THE most unprejudiced American who ever sang the praises of God's Own Country will not deny that the U.S. is a land of hard cases. It is not very surprising, therefore, to learn that steel-encased valves, literally all metal, have made their appearance in New York, under the auspices of the G.E.C. Instead of glass, steel or iron is used for the bulb, rendering the finished product practically bump-off proof.

Half a dozen types of these valves have been put into production.

Pretoria Next.

THE wireless station being erected at Roberts Heights, near Pretoria, is going to be a regular up-and-do-er by all accounts. One of its transmitters will be a short-wave telegraph and telephone set, similar to one at Rugby, and capable of world-wide range. This set's wavelength will be crystal-controlled.

In addition, there will be communication with aircraft flying on the South African air routes, by a comparatively low-powered equipment, and a Standard-Adcock direction-finding system.

The Late Dr. Goldschmidt.

THE recent news of the untimely death of the great Belgian wireless pioneer, Dr. R. Goldschmidt, came as a sad blow to many scientists in this country. He had been Secretary-General of the International Radio Commission, and of its successor, the International Scientific Radio Union.

It is not generally known that when his scientific-measurement transmissions from his Lacken station were interrupted by the war in 1914, some of the essential equipment of that station was hidden under an altar in a Belgian church, and remained undiscovered throughout the German occupation.

Nature Note.

NATURALISTS are wondering what to make of a story about a meadow-lark that comes from station W O R, Newark, N.J. This wily (or fortunate) bird built its nest in a disused coil of wire near the transmitting aerial, and the H.F. currents induced by the adjacent 50 kws. warmed the nest so effectively that hatching out became a pleasure.

The story is reported in all seriousness, but I am glad the bird in question was only a meadow-lark—a swallow would have been more than we sceptics could swallow.

ARIEL.

The A.I.F. Assembly

A NOVEL ALL-IN BATTERY SET FOR ALL PURPOSES

Described by
G. V. DOWDING,
Associate I.E.E.

THERE is a subtle difference between fried fish and fried bacon which may or may not have occurred to you. The one exists in both a homemade and a commercial form for home consumption, and the other is peculiarly a product of home-construction, but is probably the more popular of the two, but that is by the way.

The average set design is the fried fish of radio and the object of the designer of the home-constructor version is to provide something that is a bit better or cheaper (or both) than anything like it which can be purchased ready made.

The A.I.F. Assembly does not fall into that category, though judged as a radio set, it is more complete than the average battery instrument, and is certainly better and cheaper. It is the result of an idea which occurred to me recently and which was so well received by all to whom I mentioned it that I at once had it translated into practical form.

Self-Contained.

Described in a few words, it is a self-contained battery set in chassis make-up. As it stands in the form in which it appears on page 437, it is a complete, working radio receiver requiring no external speaker, aerial or anything else.

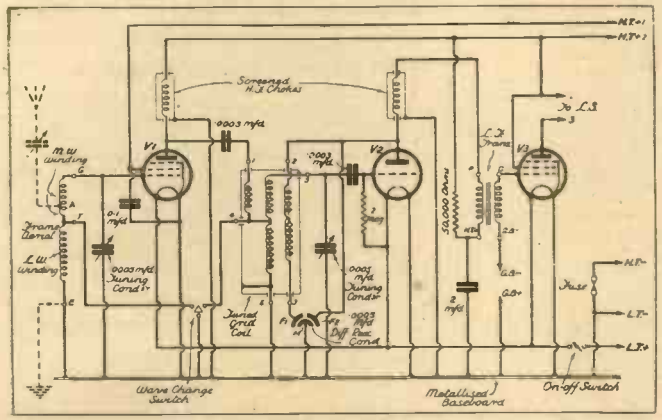
Its great point of novelty is that it is so shaped and is so compact that it can be used in a number of different ways. For example, you could fit it into a simple carrying case and you then have an excellent portable, light, compact and efficient.

Alternatively, three sheets of three-ply could be tacked on (or a "posh" little cabinet constructed if desired), and the A.I.F. Assembly becomes a most attractive table model.

Again, you need do none of these things, but can tuck the Assembly away on a bookshelf or in some other convenient place to constitute an unobtrusive or even completely concealed radio installation.

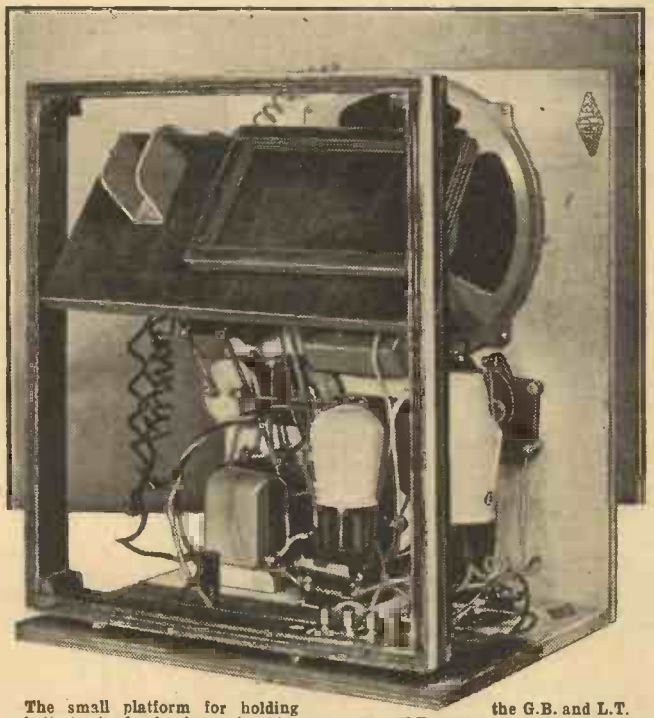
In no instance need any particular disposition be permanent, the Assembly is always ready to be transformed into a portable or some other form as desired.

A DUAL-PENTODE THREE



It will be seen that two pentodes are used, one for H.F. amplifying and the other in the output stage. An external aerial and earth may be employed if desired.

VIEWED FROM THE BACK



The small platform for holding the G.B. and L.T. batteries is clearly shown in this view. The H.T. battery is placed on its side, immediately beneath the platform.

I am sure you would all find your own individual uses for such a design.

Don't imagine for a moment, though, that it is one of those "pip-squeak" little affairs which can give nothing but a travesty of programme items. In power and quality it is a quite surprising set, and its performance is out of all proportion with its size.

It is true that there is only a small frame aerial for picking up the minute quantities of radio energy which emanate from the various stations, but the circuit of the A.I.F. Assembly includes two pentodes and an iron-cored coil, and the speaker is a particularly efficient one.

A Listener's Set.

It cannot be claimed that it will bring in a hundred programmes any time they are wanted. But one could well ask how many want a hundred programmes, anyway? No, the A.I.F. Assembly is a listener's set, giving a few programmes of good power and quality rather than a D.X.-er capable of tuning in the world thinly.

The reproduction is amazingly full. To a large extent this is due to the very fine moving-coil loudspeaker which has been employed. The quality is comparable with the better commercial sets.

That does not apply to the cost. The A.I.F. Assembly is definitely an inexpensive set, and the whole thing, including valves, batteries and speaker, works out at well

(*Continued on next page.*)

THE A.I.F. ASSEMBLY

(Continued from previous page.)

under £6. Also it is quite simple in its construction and despite the smallness of its size there is no trickiness at all in its layout.

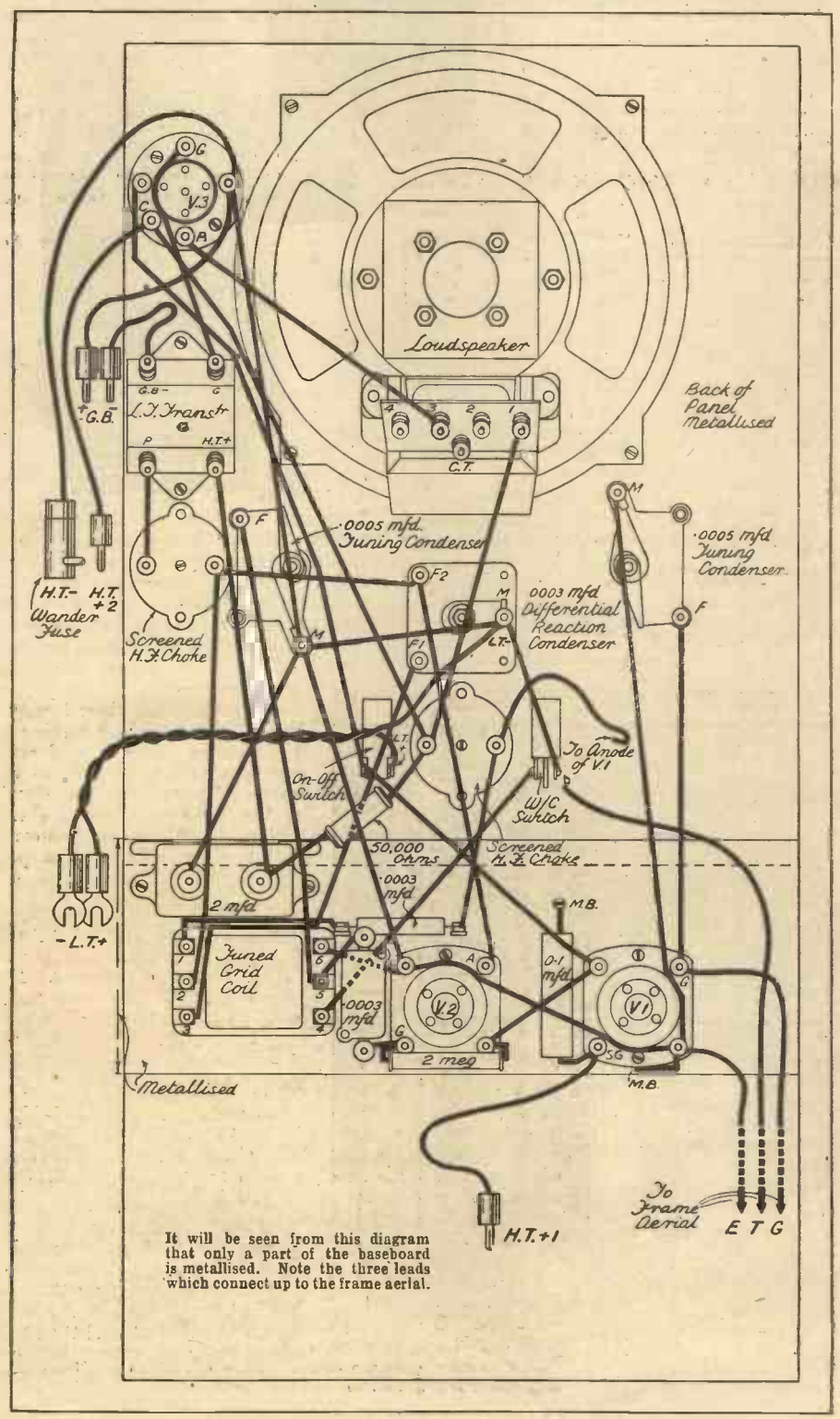
The term "fool-proof" is, in my opinion, an objectionable one, although unfortunately there is no other which so pointedly describes an outfit of this nature for, so long as the specification is fairly closely followed, I cannot see how anyone who exercises a modicum of care can go wrong.

Of course, if people *will* try to use any old components and wire them up with corroded bell wire——!

But, quite seriously, this question of components does become one of real importance with a set such as the A.I.F. Assembly. The parts have been very carefully chosen. It is quite possible that there are other makes of some of them which might prove adequate, but in at least some instances it is not merely a question of degree of efficiency.

There are two or three makes of solid dielectric variable condensers which, although no doubt perfectly suitable for many other purposes, would quite ruin the A.I.F. by introducing electro-mechanical oscillation.

LAYOUT AND WIRING OF THE COMPONENTS



It will be seen from this diagram that only a part of the baseboard is metallised. Note the three leads which connect up to the frame aerial.

The Chassis Framework.

All the framework of the chassis and the frame aerial are constructed from ⅜ in. plywood. The panel is Metaplex. Metaplex is sold by Messrs. Peto-Scott and costs little more than ordinary ply, but it does away with the necessity of using metal foil, for it is quite essential to have the back of the panel metal covered.

From this you will gather that Metaplex which carries its metallising on only one side and the edges is what is required. But only a part of the one surface of the baseboard requires to have this covering. That part which lies underneath the components. It isn't desirable that the metallising should extend further towards the frame aerial than that.

You can buy Metaplex with only a partial covering or you can use the ordinary fully-covered type and plane the necessary area off. Again, you could use ordinary ⅜ in. plywood for the baseboard and cover a portion of it with metal foil, holding this in place with drawing-pins.

A circular hole as shown in the diagrams needs to be cut out of the front panel for the speaker and you will have to countersink for the securing nuts of the variable condensers. This latter operation is quite simple if you have a brace and bit, for this will quickly enable you to shear away about a ¾ in. circle of a layer and a half or two layers deep. Failing that useful tool, a sharp-pointed penknife can be used.

For the hole for the speaker a keyhole saw or a fret-saw is needed.

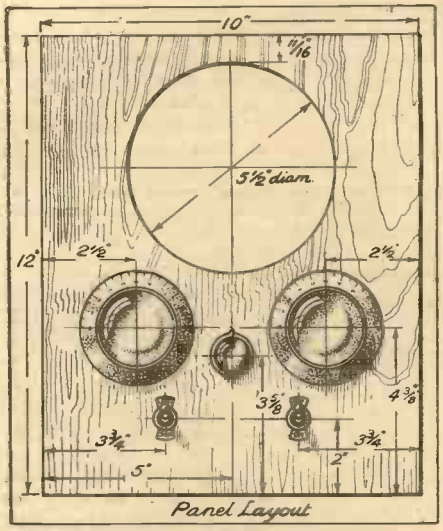
Mount the components on the baseboard and the panel before attempting to fix the loudspeaker in position, and leave the

(Continued on next page.)

BUILD YOUR SET WITH THESE PARTS

1 Formo screened "Sensity" coil, type P.P.I.
2 Polar ·0005-mfd. solid dielectric tuning condensers.
1 Polar ·0003-mfd. differential reaction condenser.
1 Bulgin on/off toggle switch, type S.80.
1 Bulgin W/C three-point toggle switch, type S.87.
2 Bulgin screened H.F. chokes, type H.F.8.
2 Benjamin "Vibrolder" 4-pin valveholders.
1 Benjamin 5-pin valveholder.
1 Varley "Nicket" L.F. transformer, ratio 1/3·5.
1 T.C.C. 2-mfd. fixed condenser, type 50.
2 Dubilier ·0003-mfd. fixed condensers, type 670.
1 Erie 2-meg. grid leak, 1-watt type.
1 Amplion 50,000 ohm fixed resistance, 1 watt type.
1 T.C.C. ·1-mfd. tubular fixed condenser.
1 W.B. Baby Stentorian loudspeaker.
1 Peto-Scott "Metaplex" panel (polished reverse side), 12 ins. by 10 ins. by ⅜ ins.
1 Peto-Scott baseboard, 10 ins. by 8 ins. by ¾ ins. ("Metaplex" 10 ins. by 3½ ins.).
1 oz. 34 S.S.C. wire.
1 oz. 32 D.C.C. wire.
Wood for frame aerial.
4 Clix wander plugs.
1 Belling and Lee wander fuse.
2 Belling and Lee spade terminals.
1 coil B.R.G. "Quikon" connecting wire.
Screws, flex, etc.

Note: The frame aerial can be obtained ready made from Peto-Scott if desired.



The symmetrical panel layout makes for ease of drilling. The two dials are for tuning, and the small knob in the centre controls the reaction. The switch on the left is for wave-changing, while that on the right switches the set on and off.

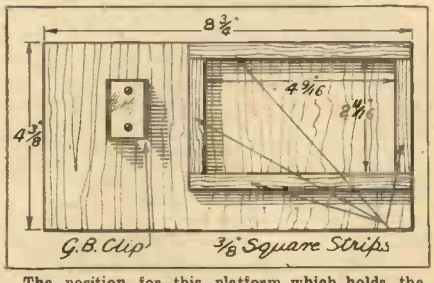
mounting of the frame aerial until all the wiring with the exception of the frame's own connections has been carried out.

Joining the Corners.

Use one inch veneer pins for tacking the four pieces of the frame together. One in each corner will suffice. Additional support is provided by ⅜ in. square blocks, which are glued in the corners, the fixing of these being reinforced by ¾ in. veneer pins. Now mount the four terminals and drill holes for carrying the wire through. The windings are in the same direction, and the one is tapped as indicated in the drawing.

Slots ⅛ in. in width should be cut in the corners of the frame to take in the long-wave winding, for this is wound in a bunched form and not in a single layer, as in the case of the medium-wave binding. The slots

THE BATTERY PLATFORM



The position for this platform which holds the G.B. and L.T. batteries will be seen from the photograph on the first page of this article. It is attached to the frame aerial by two screws, and rests on the H.T. battery.

are cut diagonally across the corners and are about ⅜ in. deep. Use a little seccotine or glue or, better still, shellac here and there, to keep the medium-wave turns in position. An alternative method is to employ some adhesive tape.

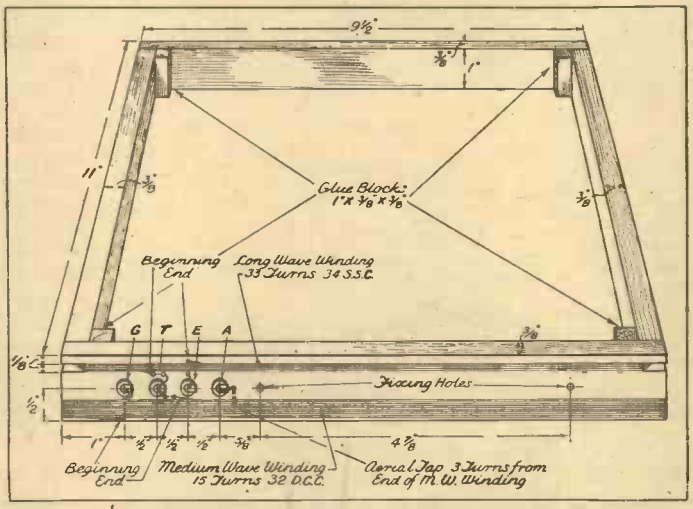
When you have wound the frame aerial and fixed the "battery board" (which is also of ⅜ in. ply) to it you can fashion and mount the G.B. battery clip, which you can make yourself from a piece of sheet aluminium, brass, or tinned iron. A couple of ¼ in. screws will hold it securely in position.

Inserting the "High-Tension."

The battery board is pivoted inside the frame aerial by means of a couple of wood screws having a fairly easy if not loose fit through the frame so that the board is hinged. The board is swung up to enable the H.T. battery to be put in place and is then dropped so that it rests on it and provides a shelf for the accumulator and the G.B. battery.

The frame aerial should be raised a quarter of an inch from the baseboard, and you can do this with a couple of old terminal heads or anything else of a like nature. The fixing screws (⅛ in. or 1 in.) are passed through the improvised washers.

DETAILS OF THE FRAME AERIAL

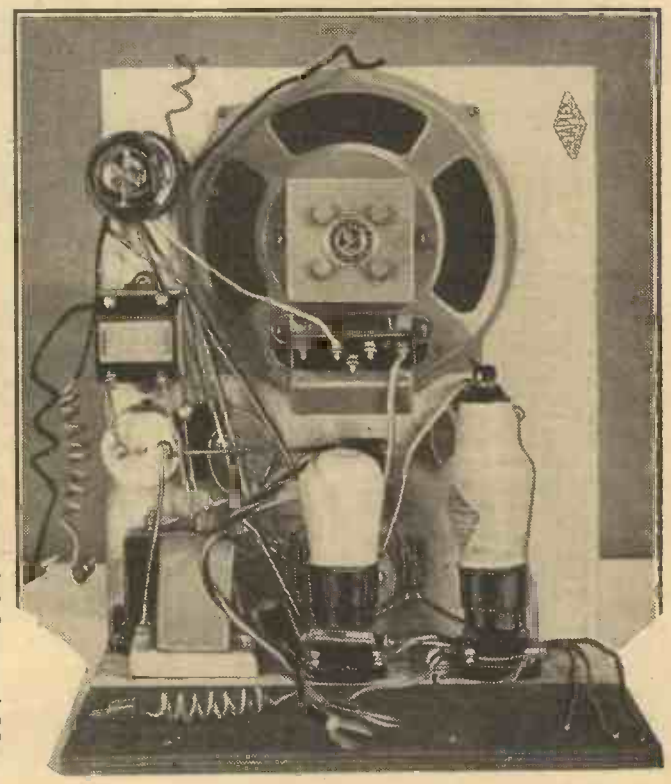


All the necessary information for making the frame aerial is given in this diagram. The points E.T. and G. are joined up to the three flexible leads, which are marked to correspond in the wiring diagram on the preceding page.

It will be noticed that the Metaplex has not been used as a common current-carrying conductor, and there are only a couple of connections to it.

M.B. Connections.

There is really nothing more which requires to be said about the construction of the Assembly. The diagrams have been drawn in detail so that they are all but self-explanatory. But don't forget those connections to the metallised baseboard. It is curious how many set builders seem to slip up in that respect. I suppose it is because there are no terminals concerned with the actual connections and set wiring has become so much a matter of "one terminal of this to one terminal of that, other terminal of this, etc.," that the constructor tends to check his wiring by terminals rather than by leads.



The completed chassis ready for wiring up to the frame aerial and batteries. The valve to the left of the loud-speaker is the L.F. pentode.

ACCESSORIES REQUIRED

VALVES.

S.G. Cossor 210.S.P.T. — Det. Cossor 210.H.F.
Output. Cossor 220.H.P.T.

BATTERIES.

H.T. 120 volts.
L.T. 2v. Exide P.O.2.
G.B. 4½v.

One wire end of the ·1 mfd. fixed condenser is joined to the metallised baseboard by making a small loop in it, and holding this down in contact with the metallised surface by means of a small washer and screw.

There is a short lead from the one terminal of the adjacent valveholder, which has its end bared and laid under the valveholder.

Use the full H.T. for H.T. +2 and about 90 volts for H.T.+1. With the smaller type of output pentode a full 4½ volts grid bias will prove an economical and satisfactory adjustment.

The tuning of the set is straightforward, but in view of the fact that a frame aerial is employed, the set is both selective and directional. Therefore, for greatest volume you must arrange the Assembly in line with the station you want to receive—roughly anyway.

BARRY KENT CALLING

News and Views from the "Big House"

A MEMBER of the Adult Education Advisory Committee of the B.B.C. has been telling me of an interesting debate in that committee recently, when the treatment of religion by radio was fully ventilated in the presence of Mr. Iremonger, the Religion Director of the B.B.C.

The proposal was to work out a basis for a challenging series on the fundamental religious issues which interest the ordinary man. It was agreed that such a series should be given on week-days, and that speakers must be blunt and candid in their views. The B.B.C. was invited to proceed accordingly.

* * *

A Television Stir.

There is much activity at Broadcasting House, getting ready for the Alexandra Palace Station that is to be hastened forward in every way possible. Mr. Gerald Cock has prepared his plans and incorporated them in a memorandum that the Board of Governors are considering. Mr. Eustace Robb in his turn is developing programme possibilities, and Commander Val H. Goldsmith is assiduously clearing up the difficulties on the business side.

From the inquiries from listeners that reach the various offices of the B.B.C. in increasing numbers daily it is obvious that the expectation of television is getting more acute. It is understood that the B.B.C. has been advised that the financial problems will be solved through the acceptance by the Government of the recommendation of the Ullswater Committee, already made, that a vigorous scheme of television development be financed immediately out of the Treasury share of licence revenue.

* * *

Physical Jerks Now Assured.

I know I shall be angrily challenged; equally, I know I am right when I say that we shall have early morning physical exercises on the British Air at the beginning of next year. And this is the way the whole thing comes about. For about eight years there have been spasmodic attempts to get the B.B.C. to put on breakfast time broadcasts of the type with which listeners in America and the Continent are familiar. The answer usually has been that the public demand is insufficient to justify the extension of staff and equipment which it was alleged would be involved.

Spokesmen of the B.B.C. also added "but not, of course, to be quoted," that the average healthy inhabitant of these Islands, in other words, the average broadcast listener, was far too superior a person to be inflicted with the kind of claptrap that foreigners might care to substitute for honest eggs and bacon.

Well, there may have been something in all this; but now a new factor intervenes and that is the "Youth and Fitness" movement, to which the Jubilee has meant so much. And the Government is interested, so the B.B.C. will act in due course and the "course" is not so long distant either.

* * *

More Fees Bother.

I have yet to meet any responsible and knowledgeable student of broadcasting who has complained about the £2,000 which was paid to Toscanini for his four concerts with the B.B.C. Opinion is agreed that the figure was just about right. Why, then, all the bother that has happened since the fee "leaked"?

A FIRM FAVOURITE

LEONARD HENRY, the popular comedian. Has broadcast in revue, musical comedy, vaudeville, the children's hour, surprise items and comic opera. On the occasion when he appeared at the Royal Command performance in 1932, and just as the King and Queen arrived, an old lady in Tooting rang up and asked him to come and put her wireless set right.

The B.B.C. should be quite firm and announce certain typical fees for certain special classes of artistes, irrespective of nationality so far as the top-notchers are concerned; but with differential treatment so far as middle and minor artistes are concerned, in a way absolutely and clearly defined. Let the B.B.C. do this, and I venture to prophesy that the situation will be eased rapidly and that the resultant publicity will extend over the whole world.

It is not necessary or desirable for the B.B.C. to give all the facts and details of its financial arrangements with artistes and others, but it is both necessary and desirable that the B.B.C. should convey to the listeners, who are its real owners, a feeling of confidence that licence revenue is being spent for the most part in good programmes and not in bricks and mortar, as is sometimes alleged.

* * *

"Yankee Doodle."

July 4th is Independence Day in America, so Martyn Webster is presenting a programme for Midland listeners representing American music, including old familiar numbers from the cotton fields, as well as the modernistic type of music from Tin Pan Alley. Reginald Burston will conduct the B.B.C. Midland Orchestra and the Midland Revue Chorus, and the soloists will be Marjorie Westbury, Geoffrey Dams, Jack Wilson, Gerald Martin and Cuthbert Ford. The title of the programme is "Yankee Doodle."

* * *

"Bouquets."

Light entertainment comes from Scarborough on July 4th, when Northern listeners will hear the "Bouquets" concert party broadcasting from the Spa Theatre, and Hal Swain's Dance Band from the Spa Ballroom. The "Bouquets" are directed by Murray Ashford, who acts as "entertainer" for the party, and the cast also includes Gladdy Sewell (comedienne), Laurel Mather (soprano), Walter Amner (comedian), Jack Howard (baritone), Mary Erne (soubrette), Lionel King (entertainer), Ralph Johnson (piano), Carlo (accordionist), and Marie Colores and Jean Pierre (speciality dancers).

ON THE AIR

Candid comments by our broadcasting critic on recent programmes.

WHIT-MONDAY has its own opportunities for stirring up heroic spirits. Yet the B.B.C. offered another on this day by presenting "The Golden Hind." Candidly I didn't listen to the whole of this broadcast, for I felt it ran counter to the holiday mood rather than contributed to it. Fortunately, an A1 cast was engaged to do it—all favourites of mine. And Flora Robson was an added attraction. What a lovely speaking voice she has! And Godfrey Tearle! And Norman Shelley! In spite of these advantages I would have preferred "The Golden Hind" on a winter's evening. Whit Monday's mood is a special one, requiring special holiday fare.

* * *

Harry Pepper's cast of White Coons seem sa more appropriate one for a Bank Holiday. Yet these were put on later in the week, when Whitsun, 1935, was already a thing of the past. I like these White Coons. They are a gay crowd, and have something for all tastes. They have single and concerted items, choral and otherwise. "The House She Got From Uncle Toby" is a good specimen of the humorous concerted item. Tommy Handley is an acquisition to the Coons. I like his topicality. He has a winner in his "Pleasant Stroll in the 'Bunyan' Country." It seems that newspaper itineraries for the hiker have misled him as badly as they have me.

A Type of Turn I Like.

Wynne Ajello's followers should have been completely satisfied with her "Blackbird Song," while Paul England couldn't have let his fans down with his song "How Can I Hold You Close Enough?" The type of concert-party turn that always appeals to me is the boarding-house one with landlady and boarders complete, all gathered round the festive board. The White Coons have a beauty of this kind.

* * *

The Gilbert and Sullivan relays from Sadler's Wells remind me of a complaint I have received from a correspondent. He says, "Bands and orchestras never seems to play much else of the G. and S. operas than 'The Mikado' and 'The Gondoliers.' We never hear 'Patience,' for instance, unless an occasional number from it is included in a 'Selection' of the operas." I am inclined to agree that this is true.

(*Continued on page* 438.)

ON THE SHORT WAVES

THAT "COMMERCIAL FINISH."

Some hints and tips which will help you to obtain efficient and attractive apparatus.

By W.L.S.

HAVE you ever noticed how much better a set seems to work when you take a pride in it? It's a funny thing, and, I suppose, more fitted to an article on psychology than to a short-wave page; but there it is. Never mind whether it's radio, stamp-collecting, cycling, or whatever you like—you always seem to get on better when you start being particular.

No Need for Expensive Parts.

Now there *are* exceptions to this, of course. Some of the flashiest cars I have ever seen would be put to shame by the performance of a mud-encrusted old veteran, and some of the most beautiful receivers I have seen were simply paint and powder, without (to put it vulgarly) "guts"! That probably would form the basis of a nice little lecture on the subtle distinction between pride and swank.

People like myself, whose radio life is one long round of pulling to pieces and re-assembling, might be excused for taking reasonable pride even in untidy bits of gear; but readers who settle down to one receiver and leave that in a dirty, spidery, unbusinesslike shape ought to be ashamed of themselves.

Now don't get the idea that I'm trying to get you to spend a fabulous amount of money on buying marvellous metal boxes, expensive dials, and the rest. On the contrary, I think it's time you started building your own stuff a bit more.

When I "come all over posh," as a friend puts it, I build something like the little set illustrated on this page. As a matter of fact it is a two-valve 5-metre receiver, but that doesn't concern the argument. I did *not* spend a lot of money on the case, which is a five-year-old aluminium screening-box brought up to 1935 ideas with a coat of grey cellulose, such as one can buy at any hardware shop.

Using Biscuit Boxes.

A friend of mine (even more impecunious than I am) has made a wonderful job of his station with nothing more than a stock of biscuit-boxes similarly treated. He made himself pretty ill eating up the biscuits to start off with, but he thinks he has been well repaid, and one certainly wouldn't know the past history of his rows of grey cellulose cases.

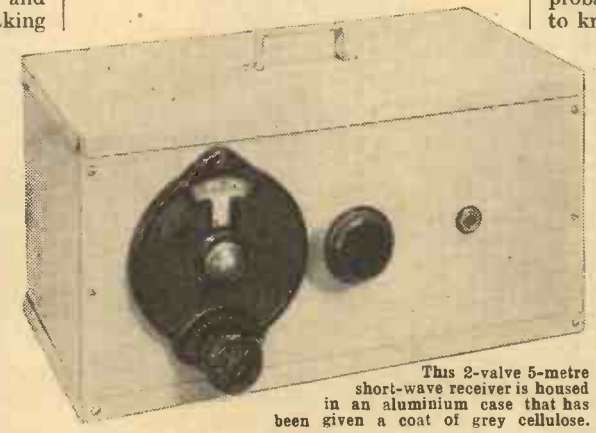
Now you may be asking why I ramble on like this when I'm supposed to be talking about short waves. Well, for one thing, this sort of business concerns the short-wave man more than the general radio enthusiast. His apparatus is mostly in small units, and even if he aspires to possess a big superhet he can quite well spread that over three boxes.

I should always build a superhet that way if I were making it for myself. The H.F., detector and oscillator can go in the first box; the I.F. stages in the second; and the second detector and L.F. amplifier in the last.

The boxes can be neatly linked together at the back with two or three wire cables a few inches long, and the whole thing can be made to look far more businesslike than some of the "period" furniture that serves to disguise a superhet nowadays.

Another good scheme is to build your gear on the "rack and panel" principle. All you need is some 1-in.-square battening,

A GOOD FINISH



This 2-valve 5-metre short-wave receiver is housed in an aluminium case that has been given a coat of grey cellulose.

which can be planed down and painted black. Your rack can be of any convenient dimensions, the various panels being arranged either vertically above each other or horizontally in a long row.

I have seen a complete amateur transmitting station arranged in this way, and it has made a nearer approach to "commercial finish" than others on which the owners have spent ten times the amount of cash.

Then take some of the detail work about the place. Why not give your battery leads and your aerial lead-in a special treat? What looks neater than stiff wire held off the bench with baby stand-off insulators? And, one might ask, what looks *worse* than an aerial crawling across the bench by way of ancient flex with three or four twisted joints in it?

I'm no psychologist (I hate the word itself), but I do know what a difference these things make to the outlook of the owner of the gear. Imagine the owner of a real "hay-wire" station harassed by some elusive crackles. He just says to himself, "Well, look at all those loose bits of wire—it might be any of them. I'll have a look to-morrow." Sometimes he does; more often he doesn't.

The owner of a neat station notices the onslaught of the first crackle, however slight, and goes for it until he finds it. A tidy station, in other words, begets a tidy mentality, with a corresponding improvement in results.

A Matter of Luck.

I can see sceptical smiles slowly spreading over the faces of some of my readers, who are fortunate in getting excellent results with "junk-heap" apparatus. Well, you owners of the smiles, you are lucky, and probably to be complimented. You have to know what you're doing before you can take libertics, and, generally, it's only the old hand that possesses the knack of making a real junk-heap perform well.

If only they would realise, though, that they stand to get on even better when they acquire a little "commercial" outlook, they would get much more fun out of the game and be able to take even more pride in their gear.

Incidentally (I have only just discovered it), one can buy "crackle-finish" paint at certain oil-shops. This is just painted straight on to a metal box and dries with a kind of "crazy" finish which is very effective. It isn't equal to commercially produced articles of the same type, but it's good.

Other Points to Watch.

Other things I might attack, if I had space, are ancient and dirty brass terminals; acid-sodden accumulator tops; matches as substitutes for wander-plugs; insulating tape; and especially aged ebonite panels that have gone green from exposure to sunlight.

I am all in favour of the wooden panel idea, especially as we short-wavers always see that the only components mounted on the front are at earth potential. There really isn't any point in the use of insulating panels these days.

If your conscience pricks you after reading the above, I hope you will turn over a new leaf and be pleased with better results for evermore!

ON THE SHORT WAVES—*Page* 2.

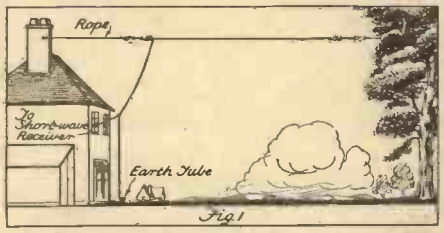
WHAT READERS ARE SAYING

W. H. T. (W. 2) has had me in fits of laughter for some few moments with a letter on the subject of short-wave reception and its supposed joys. He quotes poetry extensively and wipes the floor with several short-wave scribes, and one in particular. His letter demands a whole article to itself, and I hope to deal fully with this vexed problem of short-wave programme-value later on.

J. E. (Leeds) tells me that he has received a verification of his reception of the Graf Zeppelin on 35 metres at a distance of about 3,900 miles. J. E. has been working on short waves for three and a half years, and yet has never seen another short-wave set or met anyone interested in the game.

He comments upon the beastly type of note put out by some commercial stations and by several of the biggest liners, and wonders why they can't turn out something better. We've all had that feeling sometimes, J. E.! Yes, listening to shipping is a fascinating business; you never know whether you've got hold of a choice bit of "D X" or a mere local.

FOR STATIC TROUBLES



A reader strongly recommends a trial of this type of aerial system when "man-made" static is bad.

R. W. (S.E.27) strongly recommends readers troubled by "man-made" static to try an aerial arrangement like that shown in Fig. 1. The down-lead of the aerial is taken straight down to earth and the set tapped on. In his case the tapping-point is about one-third of the way up the total length of wire from earth to the free end.

I have often used this kind of arrangement myself, but of course it's hopeless to expect it to work well on all wavelengths. On certain settings the effect is precisely the same as hitching a direct earth on to the aerial terminal; but it certainly is well worth experimenting with.

A Peculiar Echo Effect.

R. J. A. (Holloway), whose log on P R F 5 was reproduced recently, comments on the peculiar echo effect sometimes noticed on G S F in the 19-metre band. He wonders whether this is due to double reception—once by direct ray and once right round the world.

Several of the high-powered commercials go like this at times, and it has sometimes been impossible to copy them owing to double echoes. Scientists have, of course, been investigating the whole business of delayed echoes for a long time. One of them seems to come from the moon, and others from all sorts of queer spots in outer space, judging by the time-lags.

R. L. (Manchester) asks me to mention that the Manchester Chapter of the I.S.W.C. is holding a conventionette on June 30th from 3 to 10 p.m. at the Assheton Arms Hotel, Long Street, Middleton. If any "P.W." readers want to go, they are asked to notify Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, as soon as possible.

F. G. R. (Southampton) mentions reception of G 5 M L (Kenilworth) on 20 metres, and inquires whether it is an oddity, as he doesn't often hear British stations on that wave. G 5 M L, of course, uses fairly high power and is an outstanding "D X" station, so it isn't surprising that he should be heard, possibly on his ground wave, at that distance.

WHAT TO HEAR—WHEN TO LISTEN

A guide to the best times and wave-lengths for short-wave listening.

NOW the "Summer conditions" are in full force, the short-wave enthusiast has to readjust his ideas about the best way of spending his time on the air. If anything, he finds that the "peak" hours are later nowadays, and that the latter part of the evening is altogether more interesting than it is during the winter.

The 16-metre band, instead of being a mere flash-in-the-pan for an hour during the afternoon, yields good, strong reception until 6 p.m. or after. There are not many stations on that band, it is true, but those that do work there are good.

The 19-metre band is the best of them all for really strong signals. Recently, between 4 and 5 p.m., I gave the band a casual look-over and found nine stations working. W 2 X A D and W 8 X K are well known, of course, but in between them nowadays it is possible to find W 2 X E and to mistake him for one of the better-known stations.

Good Volume From W2XAD.

D J B and D J Q, the two stations at Zeesen, sometimes put over the same programme simultaneously on this band, one working on 19·73 metres and the other on 19·63.

If you want to hear the strongest transmission from America that you are ever likely to hear, listen for W 2 X A D on his 8–9 p.m. schedule. Many short-wave novices who have never before heard America have logged X A D as R 9 during the past few weeks.

The 25-metre band is patchy, but usually interesting from 8 p.m. onwards. A Colombian station, H J 4 A B A at Medellin, has recently appeared on this band, and comes over rather well when conditions are right for South America. It is also possible, if you are lucky, to hear K I O at Kauhuku, Hawaii, on this band, but you may have to wait until after midnight before he reaches any strength. It is also worth listening during the early morning (6 a.m. onwards) on the off-chance.

The "stock" time for the 31-metre band is, of course, Sunday afternoon, when all the world and his wife listen to Sydney's transmission from V K 2 M E. It is also a good band at night, however, and any spare time between 11 p.m. and midnight can also be profitably filled up by scouting round between 28 and 38 metres, with special reference to the official broadcast band between 31 and 32 metres.

H P 5 J, Panama City, is now officially listed as working on 31·28 metres, so that you should be able to find him on the same setting as V K 2 M E (but not at the same time).

Reception From Melbourne.

V K 3 L R, Melbourne, may be heard any morning except Sundays between 8 and 10 a.m. V K 3 M E, also at Melbourne, is listed as working from 11 a.m. onwards on 31·55 metres, but no one seems to hear him in this country.

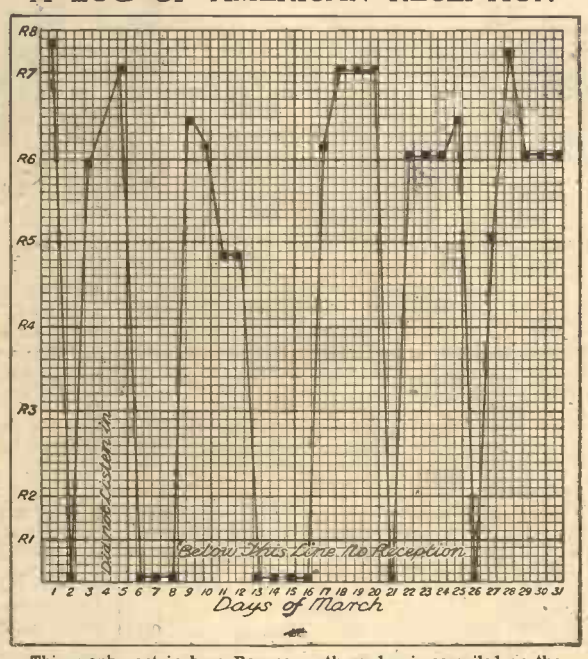
The 49-metre band, the mainstay of winter reception, is one of the least useful at this time of the year. Atmospherics are far more troublesome than on the shorter waves, and there are too many Europeans on the band for comfort. On those freak nights when they *all* come in at R 9 you haven't a chance of hearing anything else unless you possess a really selective superhet.

A census reveals that the 49-metre band, at present, is populated by fourteen stations in the U.S.A., fifteen in Central and South America, ten in Europe and goodness knows how many that are not listed!

Plan your listening, and, generally speaking, try 19 and 25 metres first, except during the early afternoons, when you had better look at them all and choose the best.

W.L.S.

A LOG OF AMERICAN RECEPTION



This graph, sent in by a Bournemouth reader, is compiled on the average strength of American stations instead of being kept on one particular station. It conforms closely with W. L. S.'s own log on W 8 X K for the same period.

Americans like BIG SETS!

A glimpse at the types of sets used in the homes of radio listeners across the Atlantic, where anything up to 25 valves may be employed in the receiver.

IN olden days a man's standing in the community was measured by the number of oxen he possessed, but nowadays anyone who loudly observed in a tramcar or bus that he had, let us say, ten cows, two bulls and a goat would be pitied rather than envied.

"One of the farming fraternity in a small way. Poor chap; a tough life and no money!" That is the sort of thing that would be said of him.

But supposing he was heard quietly to remark to a companion that he had a ten-valve radio set. Ears would at once prick up and he would become a centre of interest. In this country, anyway, because here we run to "small" radios.

Lots of Valves.

The average listener uses a three- or four-valver, and pays as much for a good one as an American does for his fifteen or sixteen-valve set.

Americans apparently like lots of valves. A sixteen-valver is by no means regarded as a de-luxe outsize. There are several U.S. manufacturers turning out nineteen-valvers.

But, then, a mains valve costs only about three shillings over there, and the mass production of components and accessories has been so organised in order to meet terrific competition that prices have been brought down to—— But wait a moment: let me quote from an advertisement of a "16-Tube All-Wave Radio." The heading to the briefly stated technical claims is "50 Advanced Features," and the words which follow are:

"Exclusive Invisible-Hands features include: High level Automatic Volume Control Action, Discriminating Automatic Tone Control, Multi-Function Dial, Micro-Tenuator, Fidel-A-Stat, etc. Covers a tuning range of 9 to 2,400 metres, enabling you easily and successfully to tune in even low-powered foreign stations up to 12,000 miles away with crystal clear high-fidelity reception. De Luxe Auditorium-Type Loud-speaker."

Five Wave-Bands!

There are five wave-bands with switching, and, of course, the outfit is an all-mains affair. Now what would you suppose the list price to be? It is fifty-seven dollars, fifty cents, and that is about eleven guineas!

It is interesting to note that short waves have become so popular in the U.S. that "all-wave" tuning appears in a very large number of the new sets.

However, to get back to the subject of valve numbers. Moving up the scale, we come to the nineteen-valvers, of which there are several different makes.

The description of a typical one reveals that it is a superhet covering both short and long waves. There are two special H.F. stages for the short waves and A.V.C., and many other such features. The output power is 20 watts.

But we mustn't linger at a mere 19 valves. We will now jump four "tubes." Before describing a really remarkable outfit, the "Scott" 23-Valve Set, which has only quite recently come on the U.S. market, we must again make it plain that we are confining our remarks to sets designed for use under ordinary domestic conditions, and listed at prices well within the reach of the average listener in the States.

A feature of the Scott 23-Valve Set, which also is an "all-waver," is that it has a practically flat response from 25 to 16,000 cycles. There is continuously variable selectivity which provides anything from a sharp 10 k.c. separation to a band wide enough to pass up to 16,000 cycles without attenuation.

The 23 valves are used in the following manner: an H.F. stage, oscillator and voltage regulator using two valves, first detector, four intermediates, second detector, special A.V.C. system using two valves, first L.F. stage, second L.F. stage using two valves in push-pull, third L.F. stage using four valves in parallel push-pull, two mains rectifiers, special noise suppressor, beat frequency oscillator, tuning meter amplifier.

A Super Receiver.

A power output of 50 watts is given by this set, and it would take a long time to detail its many refinements. For example, the A.V.C. system is really two distinct systems in one, but both work in unison to provide signal constancy at any volume level.

There is compensating tone control which functions in co-operation with the selectivity adjustment, an attenuation equaliser at 10,000 cycles to deal with heterodynes, and five separate cut-offs between 25 and 150 cycles. Fancy having cut-offs among the notes most of our listeners never hear!

And fancy having an output of 50 watts to play with! No need to worry about peaks with a set like that, for you could run it at a 6-watt level, fill the room, house and garden with music, and still leave tons of margin for sudden stresses.

But don't imagine that you would be without a rival if you possessed a 23-valver. There are still one or two 25-valvers to take into account.

Three Loud Speakers!

In one of these there are three loud-speakers, two being large moving coils to take care of the bass, and the third a horn-type moving-coil designed to be effective at above 3,000 cycles.

This set employs no fewer than eight valves in its push-pull output stage. The remaining 17 valves are employed as follows: two H.F. stages, two I.F. stages, shadow-tuning meter amplifier, combined first detector and oscillator, three for the A.V.C. including an amplifier and noise-suppressor, second detector, two in parallel for the first L.F. stage, two in push-pull for the second L.F. stage, three mains rectifiers.

It is to be noted, though, that American valves are not so efficient as British ones. It has always been the practice over there to

(*Continued on page* 438.)

DURING THE ZOO BROADCAST

A photograph taken on the occasion of a recent Zoo O.B. by the B.B.C. The two Jumbos certainly appear to be taking intelligent notice of the microphone.

HUGHIE GREEN AND HIS "GANG"

YOU cannot help liking Hughie. He is not at all precocious or self-conscious.

Instead, just a fair-haired youngster of s me fifteen summers, brimful of energy —and ideas galore !

He certainly knows how to control his Gang, too. Which is more than many a grown-up could say of twelve boys and girls simply bubbling over with high spirits and a desire to get going.

Hughie doesn't really like all this "boy wonder" stuff. He is much too keen about his show—and his Gang is his show, you understand. Each member of the Gang has to come up to Hughie's standard. It is a standard that is always getting higher, according to Hughie.

Here are all the members of the Gang, with Hughie Green himself on the left, next to the microphone. Included in the group are the Saucy Six, who perform dancing turns. The Gang originally started with five members, but now there are twelve.

Two Weeks' Holiday !

Anyway, it is less than a year since he first went on the stage at the Brixton Astoria. Last July, that was. And since then he has had only two weeks' holiday. Meaning well over forty weeks of strenuous work.

To play at the top of the bill at fifteen years of age *is* wonderful—all this "boy wonder" stuff apart. How many youngsters could say the same, or could imagine their names flashed out in electric lights at leading music-halls ?

The Gang started as a modest enough group of five young folk, but at the moment I interviewed Hughie it had grown to a round dozen. He is not looking for the thirteenth ! The youngest is a little comedienne, Joyce Cannon, aged only thirteen. The eldest is Ella Wilson, who is sixteen.

A Secret Revealed.

"How did I pick up the Gang ?" echoed Hughie. "Mostly from auditions. I always make a point of hearing everyone who asks. Last week at Swansea, for instance, I saw five applicants. You never know what may turn up !"

Then I was told a secret. Hughie is looking for a West End theatre for Christmas. Yes, he wants to stage a real panto—without any grown-ups at all. I tell you, the boy has ideas ! He took the Fortune for two nights and packed it—why not a theatre for a season ? Aim high, there's plenty of room. That seems to be the motto. And a very good one, too.

He would also like to have a set hour on the radio, of course. Like Charlot's or Ridgeway's. The trouble is to get fitted in. Always it is a question of crowding in as much stuff as possible in all too little time on the air.

A Regular Radio Hour ?

According to Hughie, he has a "wow" of an idea for such a radio hour. Only let him loose for such a period—say every two or three weeks—and he'll show them ! Well, that's the spirit. Let us see if the B.B.C. applauds it.

"Who's in the Gang ?" smiled Hughie, repeating my next question. "Let's take them in turn. Jack Hopkinson over there is fourteen, and comes from Croydon. He is a baritone, and mimics birds so that the birds themselves would be taken in !

"Willie Mars (that's the name of the boy with the basket round his neck), he's the singing chocolate boy, you know. I heard him first way up in Stirlingshire when he was selling chocolate bars. He always sings with that basket on—in case he might go too high. The basket holds him down, he says !

"Ella Wilson, now, comes from Edinburgh. She's versatile, if you like. Plays the piano-accordion wonderfully—and whistles. She's the eldest—sixteen years old. Ellen Doré is only fourteen, but she speaks five languages. She's our whispering croonette, you know. The daughter of Michael Doré, who conducts a well-known orchestra abroad.

"What about the other girls ? Well, there's Kitty Machree, whose lovely voice you must have heard singing old melodies. And Wendy Elliott, our little soubrette, coming from Brighton. She's good at toe dancing —and has a delightful speaking voice.

"As for the rest of the Gang, we have the Saucy Six as a dancing act ; and then I must not forget Ken Wood, who has been with me right from the very start. A singing comedian, he is."

ELLA WILSON

Sixteen years old Ella Wilson is the oldest member of the Gang. Besides being an exponent of the piano-accordion, she is an expert whistler.

On the Films.

I left Hughie rushing off to his tailor for clothes to wear in "Mr. Midshipman Easy," a Basil Dean film in which he will take the title rôle. This goes into production at the Ealing studios very shortly.

In this show will also figure Harry Tate, who happens to be Hughie's godfather. Radio star, music-hall top-liner, film star —what next ? Hughie's star certainly seems to be in the ascendant. Yes, a likeable lad—and a bit of a "wonder," whatever he may say to the contrary. **A. H.**

RADIO'S MAGICIAN

THE photo-electric cell is known to many radio enthusiasts simply as one of the gadgets used at the transmitting end of most television systems. And the principles on which it works, and the methods of using it in practice, are seldom appreciated.

As a matter of fact, the applications of the photo-electric cell are by no means confined to television. It is the magician which enables many of the mysteries of electrical science to be performed.

It is widely employed in advertising, industry, the timing of car racing, amusement fairs, burglar alarms, talking pictures, and so on. Also it can be used with quite simple apparatus to produce the most mystifying effects in the home.

A Very Interesting Book.

If I were to stop there, no end of readers would probably be writing in to know "How ?" So I'll tell you where you can find all this information.

It is all in a recently published book, written throughout in a manner which anyone can understand and costing six shillings. The title is "Photo-Electric and Selenium Cells," by T. J. Fielding, and the publisher Chapman & Hall.

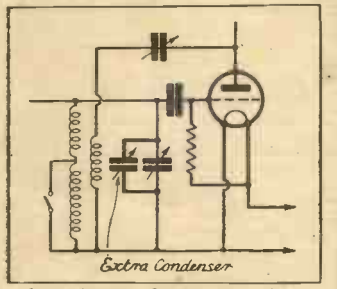
The book is full of interest to those who like to know how things are done, and to the experimenter it opens up a whole field of the most interesting work and research. It is one of the most intriguing text books that has come my way for a long time. **A. S. C.**

RECOMMENDED WRINKLES

BRINGING DIALS INTO LINE.

SOME set builders who have converted straight sets into screened-grid sets have found that the additional coil purchased does not dial like the original coil.

The left-hand dial is often a good deal out of line with the right. Example: When the left-hand dial reads, say, 140° for North Regional, the right-hand dial reads only 120°. When this is so the matter can easily be remedied by the use of a ·0001 to ·0003 preset or a small type reaction condenser. One side of the added condenser is wired to the fixed plates of the ·0005 tuning condenser, and the



An extra condenser is used to line up dial readings.

free side of the added condenser to the earthed plates of the ·0005 tuning condenser.

By rotating the knob of the added condenser the dialling of the left-hand tuner will come into line with the right. It can then be left untouched.

North Regional will show, say, 120° on both tuning dials, and the rest of the dialling will be much nearer alignment than before.

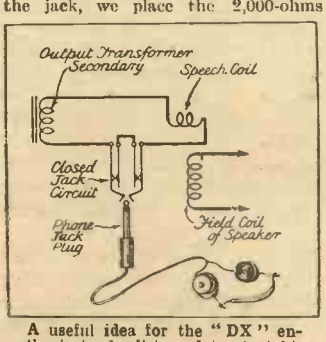
If, on the other hand, the right-hand dial, before the alteration, reads 140° for North Regional and the left 120° only, the right-hand tuning condenser can be dealt with in the same manner.

This method is often easier, and less risky, than to interfere with the windings of the respective coils.

HEADPHONES OR LOUDSPEAKER.

THE "DX" hunter's efforts at a midnight hour are hardly appreciated by the family awakened from their slumber with announcements from distant parts, thundered out on a moving-coil speaker at tremendous volume. But here is a remedy that will save his life, if not his character, when he relates of his DX-ing in the small hours.

My sketch should be self-explanatory, but, briefly, one lead from the speech coil is broken and a "closed circuit" jack inserted. This may be mounted at any convenient point on the front panel and in harmony with the general layout of the controls. Now, by inserting the phone plug into the jack, we place the 2,000-ohms



A useful idea for the "DX" enthusiast who listens late at night.

resistance of the phone coils in series with the 15-ohms resistance of the speech coil. Under these conditions the speaker will not respond, although the phones will.

Don't insert your jack in the lead to the speaker field coil or you will get a "shocking" ear full.

A SELF-SHORTING PLUG.

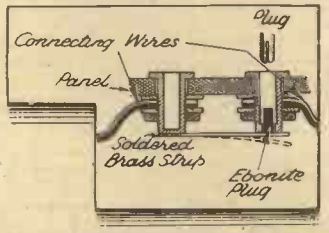
THIS idea was evolved for use with a small accumulator charger to avoid leaving an ammeter in circuit, or breaking the connections to insert one.

Two small holes are drilled in the panel half an inch apart, and banana-plug sockets slipped through and secured by nuts. The end of one socket is bored out, and to the end of the other is soldered a small piece of springy brass strip (a terminal strip from a flash-lamp battery). This strip makes contact with the open socket, into which is put a loose one-eighth-inch plug of ebonite rod.

A small two-pin plug (the type is sold with socket) has the ammeter wires connected to it. The sockets are connected in series with the output.

When the plug is out the circuit is unbroken, but when the plug is pushed home the small ebonite rod breaks the spring contact between the sockets and the ammeter comes into circuit.

I use the method also with the wireless set, where the sockets are connected in the H.T.– lead. The plug in this case is connected to a milliammeter. The method is handy, and the appearance particularly neat. There being,



Rapid insertion and removal of an ammeter are provided by the scheme illustrated.

of course, no potential between the sockets themselves or between sockets and earth, there is no danger in having them exposed on the panel.

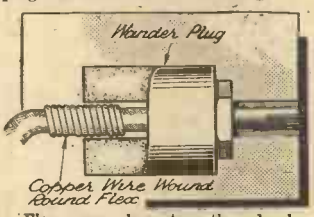
WATCH YOUR H.T. BATTERY.

THIS tip concerns the disposition of the H.T. battery. You might think that it could be laid about anyhow. The worst possible way is to lay it flat on the table. By doing this the air is prevented from circulating round the bottom, and a certain amount of dampness results. Stand it upright, or else set the battery on two blocks of wood about two inches high.

Do not let any low-potential wires run under it. I was startled one day by a loud crackling from the loud-speaker (the set was switched off). I don't know yet how it occurred, but a current evidently passed between a G.B. wire and one of the cells of the H.T. battery—it left a brown spot on the cardboard cover.

TO PREVENT FLEXES BREAKING.

FLEX leads to wander plugs which are often moved sometimes break internally at the hole in the plug and cause serious crackling.



Flex can be strengthened by twisting copper wire round at the point at which it bends most.

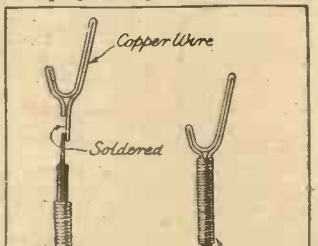
To overcome this, twist a piece of copper wire round the flex, beginning as near to the end as possible, as in the diagram.

This prevents the flex from bending so abruptly, and so prevents the wires breaking inside the flex. It also stops the wire covering from fraying, and thus makes the connection much neater.

NEAT TAG ENDS.

SOME sort of "tag" is very desirable as a finish to flex connectors, and a soldered connection of tag to flex makes much the best job of it, even though it is then subject to the trouble that the union of rigidity with flexibility makes a somewhat early fracture at the joint more than a possibility. There is generally a way out of all troubles, and this particular one can be solved by the use of short lengths of "expanding spring curtain rod," which can also form a neat finish to obviate the unravelling and untidiness of the braiding or casing of flex.

A piece of flex has its covering removed for a short distance at each end. Lengths of about three-quarters of an inch are then snipped off the curtain rod (quite easily accomplished with pincers), and when the cuts have been smoothed up with a file the "rod" can be readily "screwed on" to the flex. Multi-purpose tags can be quickly



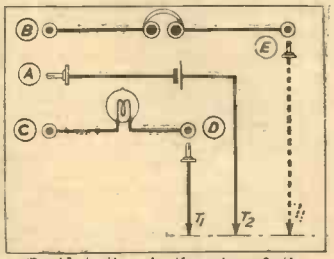
Spring curtain "rod" makes a neat finish for home-made spade terminals.

bent up from copper wire, as shown in the sketch, one end being cut shorter than the other. The end of the flex is then twisted closely, cut off short, tinned, and then soldered to the tag. If neatly done the joint will need no trimming to enable it to enter the rod, which can then be screwed up to the base of the tag, making a very neat finish, whilst the springiness of the short piece of rod will prevent rupture at the soldered joint.

A DUAL TESTER.

THIS circuit, I am sure, will be most useful for the home constructor, as many already know that you can test for continuity of a circuit with a flash-lamp, and for components with headphones. This can be made on a small box using a few wander-plugs and sockets, a flash-lamp bulb and holder, and a dry battery. By removing and replacing two plugs you have either the flash-lamp or headphones in circuit for testing.

B, C and E are sockets only, A is plug only, and D is plug and socket, so that T_1 can easily be removed, T_2 being fixed test lead from the battery. When A.C. is closed and T_1, T_2 being used as testing leads the flash-lamp is



Rapid testing is the aim of the circuit arrangement shown above.

in circuit. Remove D, T_1 and plug in E, close A B and you have the phones in circuit for testing components, T_1 and T_2 being used again for test leads (T_1 as indicated by dashes).

It will be advisable to have T_1 and T_2 a good length, so it will be convenient when going over a receiver. When not in use put A into a spare socket where there are no connections and the circuit for both will be broken and no current wasted.

WINDING COILS.

SOMETIMES when winding a choke or coil for short waves it is desirable to space the wires evenly.

If you haven't a coil-winding machine this difficulty may be overcome by winding first with a double wire and then unwinding one wire.

Three or four windings can be made according to the amount of space between the wires required.

The wire should be suitably anchored to prevent slipping.

A BETTER CONNECTION.

I HAVE noticed that the pigtail connections to the moving vanes of a solid dielectric condenser are very often a "weak point."

For instance, if the reaction condenser is used a good deal a faulty connection is often the cause of severe crackling and occasional fading.

This difficulty may be overcome by completely removing the pigtail, and in its place arranging a strip of springy metal to make contact by pressing on to the top of the spindle or threaded screw so that there is always a good contact. All wear is thus eliminated and a perfect connection ensured.

The metal used should be moderately stiff, and must be well scraped before using.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader and others published will be paid for at our usual rates.

Each hint must be on a separate piece of paper, written on one side of the page. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

SWITCHING AN EXTRA LOUDSPEAKER

A. W. YOUNGMAN puts forward some good ideas for extension-speaker control.

ADDITIONAL loudspeakers fitted in some room other than that in which the actual receiver is accommodated are mostly connected in parallel with the existing speaker, and it is very seldom that switching is utilised as a means of operating both simultaneously, or either separately. Practically speaking, the permanent-magnet type of loudspeaker can be connected to almost any receiver, and, as will be seen from the accompanying diagrams, a switching arrangement can be simply effected.

In the event of the set being one for A.C. mains operation where a mains-energised speaker is employed, the field winding is usually connected between the smoothing system and the anodes of the screened grid and detector valves, the H.T. for the ouptut being taken from the mains side of the field and fed through the primary winding of an output transformer.

In this way the latter winding is the direct path in feeding the anode of the output valve, and should it be desired to switch out the existing speaker and work only the extra one, then a substitute, preferably another choke, must be used.

The Connections To Make.

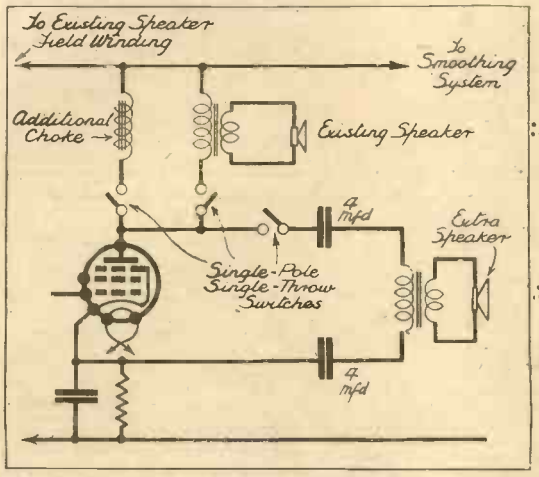
Obviously, both windings are not wanted in circuit together, therefore the switching, which employs two single-pole single-throw switches, is so arranged as to make one and break the other, according to whichever speaker is required.

The leads for the additional speaker are taken from the anode and cathode via another single-pole single-throw switch to one side of two 4-mfd. fixed condensers, whilst the remaining terminals of these condensers are joined to the speaker, as shown in the diagram, Fig. 1. Incidentally, this method of connecting is quite suitable for use with a battery receiver, although instead of one lead being taken to the cathode it is now joined to L.T. negative. If desired, the 4-mfd. condensers may be replaced by two 2-mfd.

Circuits designed for push-pull working can be adapted in much the same way, although in this instance, where two anode leads are to be considered, a centre-tapped choke instead of ordinary type is necessary in providing an alternative path for the H.T. supply. Actually the switching arrangement is no more complicated than previously, due to the fact that the main single-pole single-throw switches associated with each speaker work together. (Fig. 2.) In addition a single break switch should be used for breaking the extension circuit when the extra speaker is not required.

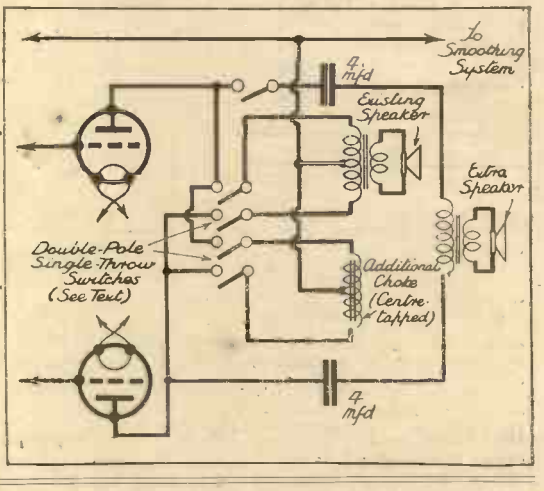
It is important to note that the various switches connected in the anode leads carry the full H.T. current, and must, therefore, be capable of withstanding the load without leakage.

WITH SINGLE OUTPUT



The method on the left is one adopted by the author for control of an extension speaker with a pentode output valve. That on the right shows how a push-pull circuit is dealt with.

A PUSH-PULL STAGE



TESTING WITHOUT INSTRUMENTS—

except a cigarette packet.

OFTEN, when a receiver goes dumb, testing instruments are not immediately available; but usually someone in the house is a cigarette-smoker, and with the tinfoil from the cigarette packet quite a number of tests and temporary repairs can be carried out.

Let us suppose a set has gone out of action.

First the loudspeaker may be tested by flicking its connecting wires across the terminals of the low-tension accumulator, and if it is in order it should be reconnected to the terminals on the set. The valves may then be tested by placing them one after the other in the output valve holder, namely the valve holder directly connected to the speaker circuit.

A Quickly-Made Condenser.

Assuming that the valves are all found to be in working order, by their giving a distinct click when inserted and removed in the last valve holder, with the set switched on, we may suspect some of the other components such as the transformers.

The tinfoil then comes into use. The strip of tinfoil from the cigarette packet is torn in two lengthwise, one piece being placed between a fold of the thin sheet of rice-paper, usually enclosed with the foil, the rice-paper being folded along its length. The second piece of tinfoil is then placed along the outside of the folded rice-paper, and the paper condenser thus formed is rolled up to get it in more convenient form. The ends from which the tinfoil protrudes may be twisted to prevent the condenser from unrolling.

To test the transformer, or transformers, the tinfoil condenser described is connected from the plate terminal of the valve immediately preceding the transformer, or from the corresponding terminal on the transformer, to the grid terminal of the valve immediately succeeding the transformer. If the fingers are now placed over the primary terminals of the transformer and results are obtained, it is certain that the primary is burnt out. A temporary repair may be effected by leaving the tinfoil condenser in place and connecting a moistened strip of cardboard from the cigarette packet across the primary terminals of the transformer. Reception under these conditions will sometimes be surprisingly clear, notwithstanding the small capacity of the coupling condenser.

Grid condensers and other small coupling condensers may be tested by replacing them, with the tinfoil one, and even a tuning condenser may be temporarily replaced by one of these handy testing condensers, as its capacity may be varied by twisting it tighter or slightly unwinding it.

Anode resistances, H.F. chokes and components performing similar duties may be tested and temporarily replaced by slightly moistened strips of cardboard from the cigarette packet.

Experimental "Telephones."

Even if the loudspeaker is damaged, earphone reception may sometimes be obtained by connecting a strip of tinfoil to the negative loudspeaker terminal on the set, placing the tinfoil between sheets of paper, placing the paper-covered tinfoil firmly against the ear, and holding the positive loudspeaker terminal with the other hand.

This gives an effect similar to an electrostatic loudspeaker, but is bound to be very insensitive.

By studying the circuit of the receiver it is possible with the cigarette packet, alone, to track down trouble in practically any receiver, without recourse to instruments.

K. F.

CURING VIBRATION EFFECTS

By VICTOR KING.

Many of the most mysterious troubles which beset the constructor are caused by effects that are least suspected. Vibration plays its part in producing some of these baffling faults, and in this article our contributor tells of his own practical experiences in tracking them down.

IT is very difficult indeed to track down some of the curious vibration effects which can occur in a radio outfit. I have seen two official service men trying to deal with a buzz in a commercial set, but they were completely baffled.

Rather amusing experience, that was. I was staying at the house of a friend whose mains set had packed up. "Don't you trouble, old man," he said when I half-heartedly offered to put the wretched thing in order, "I play golf with the manager of 'X.Y.Z.' radio; his shop is only five minutes away. I'll give him a tinkle and he'll send one of his sleuths round right away."

The Buzzing Sound.

He sent two and, applying the professional service man's first rule, they at once replaced all the valves for a new team. The outfit immediately sprang into life.

"Oh, while you are here I'd be obliged if you would do something about that buzzing," said my friend to the radio doctors. "No doubt it is only a loose screw or something."

And that is just what it sounded like. But I smoked four cigarettes during the time those two chaps tried to locate the fault. They didn't succeed, and I was greatly amused at the technical camouflage they threw up to cover their failure. They spoke glibly about a possible loose turn on the moving-coil, and muttered unintelligibilities concerning "microphony."

After they had gone, having advised my friend to let them remove the set at his convenience, I went over the outfit myself with a "finger stethoscope." That is a bone knitting needle held very lightly in the hand. But you want sensitive fingers and some experience to employ this stunt. Also you have got to know just what to keep right clear of in a mains set which is working!

Due to a Tight Strap!

I strongly advise the home constructor not to try this scheme, or if he must, to make sure he uses a bone needle and keeps his hands as far away from the "innards" of the set as possible.

I located the cause of that buzzing. It was a longish metal strap. It was tightly screwed down at each end, but just after leaving a screw it was in light contact with a ridge in the metal chassis in which the screw was bedded. After a slip of paper was forced under the strap at that point the buzzing was silenced.

Mind you, it might not have been the strap that was vibrating. Possibly it was the metal framework vibrating against the strap. I must confess that it wasn't my "stethoscope" as such which found the fault; it was merely that when I pressed on the strap fairly hard the buzzing ceased. Actually, I did not feel a vibration with my fingers.

The point of all this is that a sound which gives one the impression of the vibration of something, such as a terminal which is loose, might quite well be due to something that is apparently quite secure, or even to a purely electrical phenomenon.

I expect most home constructors at one time or another have been led right up the garden and back again by a similar kind of fault.

The most common of all is probably the "moving panel." There is a crackling or clicking when you gently push the panel of the set. Sometimes even the gentle weight of the hands when they rest on the tuning controls is sufficient to produce a noise. And when it comes to the operation of a push-pull type of switch on the panel——

"Then clearly it is the switch that is at fault," says the annoyed constructor. Maybe he puts up with the trouble for some time, but eventually he changes the switch. There is still a noise.

"Must be a loose connection somewhere, then. When the set is not touched—silence. I push the panel and make it move a little—loud noises."

Touching the Panel Causes Noises.

So he goes over the wiring with extreme care, but still cannot discover anything wrong. And subsequently to playing about with reaction condensers and volume controls, and so on, all with no effect, he finally gives up the hopeless quest and resigns himself to a dreary life with a fault which cannot be traced.

I have just been examining a radiogram which possesses exactly this mysterious fault. At least, it might be mysterious to most, but it isn't to the research department of this journal, and in passing I really must take off my 1933 bowler to those "P.W." lads. What they don't know about set faults isn't worth knowing—you can take it from me.

But to return to the particular spot of bother in question. Do you know what it was due to? Can you guess? Nothing more or less than a microphonic valve. Can you beat that? Apparently one of the stiff connecting leads ran from a panel component to the holder of the detector valve. Pressure on the panel applied a little bump through that lead to the valveholder.

It could quite well have been due to slight movement—one can hardly call it a vibration—of the reaction condenser, especially if this were of the solid dielectric type, for that is a frequent occurrence, though generally only noticeable when the set is oscillating.

Use Hefty Brackets.

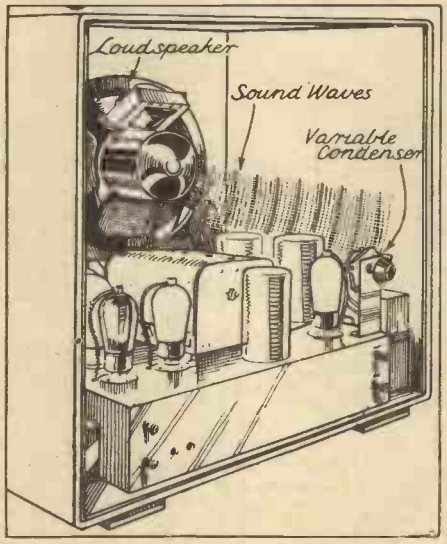
What happens is that a stiff lead joining the condenser to something fixed to the baseboard pushes the reaction condenser every time the panel is touched.

There is quite a simple cure for anything like this, and that is to use a couple of hefty panel brackets to hold the panel solidly in place. I said *hefty* brackets, you will note.

One can lay it down as a golden rule that if you want complete immunity from noises that occur through jarring the set or pushing

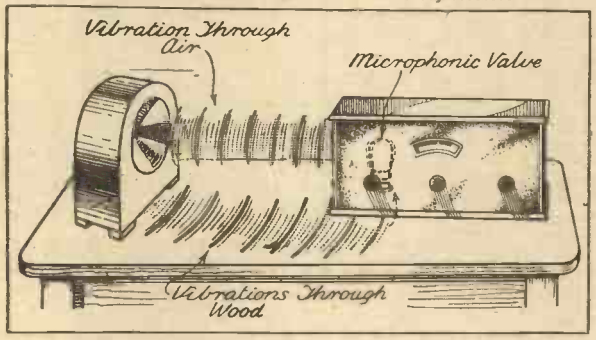
(Continued on next page.)

CAPACITY VARIATION



How the sound waves from a loudspeaker can produce capacity variations in a small variable condenser mounted on the chassis. The trouble is due to vibrations of the condenser vanes.

The effect of a loudspeaker being placed so as to face the set is shown below. The sound waves cause the valve electrodes to vibrate and so produce a howl.



CURING VIBRATION EFFECTS

(Continued from previous page.)

on the panel, the very first thing that must be done is to ensure that the outfit is rigidly assembled.

All this is quite straightforward as compared with some of the even more subtle vibration effects which can take place. Microphony in a valve can sometimes prove decidedly difficult to deal with. It is easy enough to locate the culprit. All you have to do is to tap each valve in turn with a pencil. The one which makes the most noise on being tapped is the one you will have to deal with.

Mostly a chunk of Plasticine on the valve, plus a good anti-microphonic valveholder, will do the trick. But not always. Your howl won't be so simple to deal with at times, particularly if you are one of those who like to work the loudspeaker at full belt.

Of course, all of you will be aware that the best way to start a microphonic valve howling is to direct the loudspeaker at the set. In this case the sound waves impinge direct on to the outfit and cause it to vibrate, which vibrations reach the valve through the wood of the cabinet, and so on.

Using Absorbent Pads.

But vibrations can travel through the timber of a table, too, and so it is sometimes necessary to stand either or both the set and the loudspeaker on absorbent pads. Thick felt is good, but Sorbo rubber is much better. This is if you want to use the same table for set and speaker. Even if different tables are employed it must be remembered that sound vibrations can still find their way through the air and that some table tops make excellent sounding boards!

When the loudspeaker is built into the same cabinet as the set, then it is sometimes essential to wrap one or other of the valves in cotton wool, or to apply an almost completely-enclosing layer of Plasticine.

But such a procedure won't prevent a microphonic condenser or connecting lead from causing a disturbance. What! Haven't you ever heard of a microphonic variable condenser?

No, perhaps you haven't. But I, and doubtless many others, have experienced trouble from such things. You get it mostly with the solid dielectric types of condenser. Some of these are rather loosely constructed. The sound waves reach the condenser through the air, but I think most of the trouble is usually due to vibration through the wood and ebonite, etc., on which the speaker and condenser are mounted.

AN L.F. FAULT

Loose laminations on windings in a choke or transformer often produce the effect of music coming from the internals of the set.

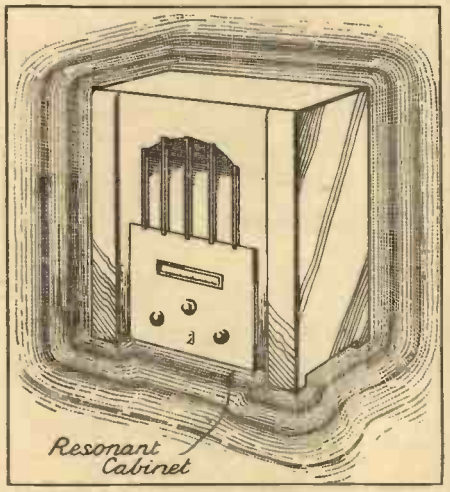
These vibrations alter the capacity of the condenser. Its thin vanes vibrate nearer and farther from the interleaved insulation. If it is a tuning condenser, then, by causing the tuning setting to vary, the H.F. energy in the circuit in which the condenser figures is modulated at the frequency of the vibration.

The Condenser must be Changed.

The only certain cure is to change the condenser for one which is more rigidly assembled. Sometimes the symptom of a "microphonic condenser" is the setting up of a howl very much like that caused by a microphonic valve. At other times you get a booming at one definite frequency, particularly if the cabinet itself is over-resonant.

It is difficult to deal with a resonant cabinet. Such a thing can by itself produce a fault. In this case there will be a muffled effect, a booming on the lower notes.

"BOOMY" REPRODUCTION



A resonant cabinet produces boominess of the reproduction, but a lining of felt or the removal of the back of the cabinet will frequently result in a cure.

Lining the cabinet with felt may improve matters, or taking off its back completely. A messy but effective cure is to apply a thick layer of plaster and glue over the whole surface of the interior. But like most of you, no doubt, this is the sort of thing which would make me put up with a lot, in order to miss it!

A vibration fault which always amuses me very much is a talking choke or transformer. Ever heard one? It's rather uncanny. You take the loudspeaker away from the set, but the music can still be heard, though generally rather thinly.

Effect of Loose Laminations.

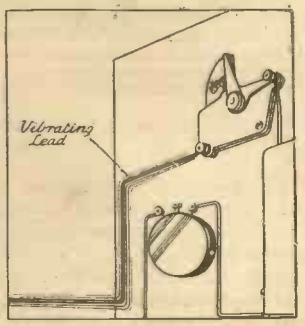
The reason for this is that a choke or transformer (one that is in the output circuit most likely) has a loose lamination or two, or loose windings, and is vibrating mechanically at the various frequencies of the current it is handling. Sometimes there is a bit of buzzing, too, and in this case it is as well to apply a cure.

The quickest way is to get another choke or transformer, the cheapest way is to try and put the original one in order. You might find that one of those securing bolts which hold the laminations of the core together could be tightened up, but more probably you won't overcome the trouble quite as easily as that.

But it can be overcome. I have dealt with a really bad case, a choke which had both loose windings and loose laminations. What I did was to soak the whole thing in a bath of shellac for a night, then let it dry hard before putting it back in the set. Of course, if you try this scheme you must remove any outer casing that can be taken off the component, so that the shellac is able to penetrate right into the very interior.

WATCH THIS!

A vibrating lead can cause all kinds of effects, especially if the set is near the oscillation point. The reaction condenser lead indicated should be kept as rigid as possible and a couple of stout panel brackets should do the trick.



It often happens that a mains choke or transformer could well be treated in a like manner, for it is not unusual to come across one which mechanically initiates hum. It is rather interesting to see how this can be done. No one worries much about a spot of direct hum, but if the vibrations which this represent cause a modulation of the radio energy by vibrating a valve or a condenser, then treatment is very desirable.

No amount of smoothing can cut out that kind of hum, you have got either to silence the vibrating choke or transformer, or prevent its vibrations from causing a modulation. And the first course is the easier, you can take it from me.

Trouble From Long Leads.

Little buzzes and jarring sounds can develop from the vibration of long leads, if these are of stiff wire. And, needless to say, loose connections, loosely fixed component shields and cases, and loose loudspeaker fitments can also produce similar demonstrations.

Yes, and a loose turn of wire on the moving coil of a speaker or a moving coil that has got out of centre must be remembered when you go chasing buzzes. And the worst of it is that one buzz can sound very much like another buzz.

The difficulty is sometimes to decide if the noise is due to a mechanical or purely electrical cause. I have sometimes marvelled at the cunningly misleading sound a badly treated valve can make

By which I mean particularly a valve that is being overloaded. In conjunction with certain kinds of broadcast items of a musical nature you sometimes hear this as a harsh, little metallic sound which is all the world like a terminal or something vibrating.

However, it is to be hoped that you, like I and others who read our P.W.'s regularly, don't overload your valves or do anything else so low! But, seriously, it is a point worth remembering and a little patience and a knowledge of all the various causes of buzzes and other noises will enable you to track them down and deal with them efficiently.

TELEVISION

TRANSMITTING SYSTEMS

An explanation of the intermediate-film process, and some remarks on television transmission in general

By L. H. THOMAS

READERS of "P.W." who are really interested in television have been well served, up to the present, with news and views on the design of receivers for the eagerlyawaited transmissions. Those who are keen on the experimental work connected with the cathode-ray tube and time-base equipment will also find their requirements dealt with fully in the future.

It is important, however, that the experimenter should also have a knowledge of the various systems of transmission, and I propose to deal with that aspect for a little while.

The Scanning Operation.

Everyone who has had any practical experience of television—even on the 30-line transmissions—must have quite a clear idea of the scanning operation as it takes place at the receiver. Let us consider for a moment what happens at the transmitter.

The subject to be televised must obviously be scanned by a flying spot of light, with which the light-spot at the receiving end is synchronised. It does not matter whether the receiver uses a disc, a mirror-drum, or a cathode-ray tube—the requirements are just the same.

In the case of the 30-line "low definition" transmissions, just as the light-spot in the television studio starts in the bottom right-hand corner of the picture, so must your spot, at the receiving end, do the same.

Now it is quite an easy matter, at the transmitting end, to scan the subject by means of a brilliant light, probably generated by a powerful arc lamp. High-definition scanning, in the "spotlight" type of studio, is, in fact, done by this means. An arc lamp of quite extraordinary power has to be used, because the light, before reaching the subject to be televised, has to pass through a rapidly-rotating scanning-disc, the holes in which are quite minute.

Intermediate-Film Process.

This is all very well in a small studio, when only one or two persons are taking part in the scene, but when one wishes to transmit an elaborate scene in a larger studio it passes right out of the realm of practical politics.

Outdoor scenes, of course, cannot possibly be scanned in such a manner, since the whole scene is already illuminated to a degree of intensity that leaves the most powerful arc-lamp standing still!

This is where the "intermediate-film" method comes in. Readers have heard a lot about it, but I doubt whether its advantages and its simplicity are understood really clearly. Many complicated diagrams of the transmitting apparatus have been published, but they are not exactly crystal-clear to the non-technical person.

Fig. 1 (a) is a much simplified diagram of the process. On the extreme left is a cine-camera, simply taking a film of the scene. This film is developed, fixed and dried with the smallest possible loss of time and is then passed on to the television transmitter.

The pictures on the film are now scanned by projecting a powerful light through them, the disc method being used to scan each picture, line by line. The film passes *continuously* through the scanning-gate—not in the jerky movement necessary for the projection of a film on to a screen.

The scanning-disc, for 240-line transmissions, has 120 holes arranged in a circle (not a spiral) round its circumference, and since each of these holes sweeps across the film while the film is moving downwards through the "gate," a complete horizontal scan is carried out.

The reason for the use of 120 holes is, of course, that the disc is arranged to revolve 50 times per second, while the number of pictures per second is only 25.

The scanning-beam falls on a photo-cell, thence to the amplifiers and the transmitter itself.

Modern ingenuity has brought things up to such a level of efficiency that a scene may be filmed and televised in this way with only a delay of 30 seconds between the two operations.

Furthermore, a continuous loop of film can now be used. After it has passed through the scanning-aperture it is stripped of its emulsion, washed, re-coated, dried, and fed through the cine-camera again!

The "Backwards" Version.

Although this is only an incidental, it is interesting to review the "backwards" version of the intermediate-film process. Fig. 1 (b) shows the schematic arrangement.

Television signals come in via the aerial and a receiver, and are reproduced on the screen of the cathode-ray tube. A cine-camera takes a film of them as they arrive, and the film is then developed, fixed, washed and dried and hustled straight off to a projector. Thus a television transmission of an important event could be shown to a large audience in a cinema within a few seconds of the actual happening.

The "intermediate-film" process is not, of course, the only one suitable for the televising of outdoor scenes or ambitious studio scenes. Everyone has heard of the "Iconoscope" and other electronically-operated devices.

I don't propose to say much about them, since they have already been explained. All that one has to bear in mind is the general principle of them—the focusing of the scene on a specially prepared plate, and the use of some form of electronic scanning.

Linking-Up.

One of the major difficulties confronting the transmission engineers and technicians is a suitable method of linking up the scanner and the transmitter proper. Obviously the entire transmitter cannot be made portable for dealing with outdoor events—it has got to be placed on a "high-spot" in any case, and the power necessary to cover a good service area lifts it well out of the range of portables!

Micro-waves, or "needle-beams," are one solution, and specially-developed cables are another. Every link in the chain, from the first amplifier after the photo-cell to the last valve in the receiver, has got to be capable of handling that enormous band-width that we are learning to associate with television.

It is, however, fairly easily obtained on waves on the order of 18 centimetres, which is most certainly a strong point in favour of micro-waves.

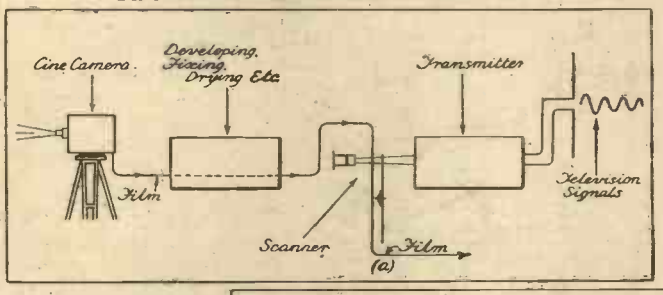


Fig. 1.—The upper diagram shows the various stages in transmission from the scene to the aerial. In the lower sketch the reverse process used at the receiver for obtaining large projected reproduction is illustrated.

TELEVISION JOTTINGS

Some up-to-the-minute remarks on various aspects of this new science.

THE fact that London's first television images are definitely to hail from Alexandra Palace should be cheering news for North Londoners. They were not too happy about their prospects had the Crystal Palace been decided upon; in fact they were in much the same predicament as the South Londoners are now!

One aspect of television that has not been dealt with very extensively up to the present is that of servicing. Of course, one always hopes that it won't be necessary—but here, and there, inevitably, it is. There will be a most distinct need for a body of trained engineers for this purpose; although service work will doubtless go in the same direction as it has done in the radio trade—to the manufacturer.

A Source for Future Developments.

Television engineers have no illusions about the brains and resources of some of the so-called amateurs. A very well-known television authority remarked to me only a few days ago that any future developments of a sensational character might easily come from that source. By "amateurs," of course, he didn't mean the ordinary dabbler, but some of the brilliant men who work quietly on a thing as a hobby, although their daily employment happens to be in some other walk of life.

They often have the kind of brainwave that just doesn't come to the man whose whole life is one long round of television—or radio, for that matter!

Everybody seems to have a kind of feeling that scanning, as we know it now, is too complicated a business to be the ultimate basis of television. What will replace it?—Goodness knows!

Mechanical Systems of Scanning.

For the time being we can only sit back and dream of a television system involving no scanning, no synchronising, no troublesome adjustments! Dare we ever hope for it?

Mechanical systems of scanning for high-definition transmissions are still being evolved. Whether they can ever cope with 400-line transmissions remains to be seen. As fast as they catch up with the proposed number of scanning lines, that number seems to increase. When someone perfects a 400-line mirror-drum or mirror-screw we shall be faced with 800-line transmissions, I suppose!

One very interesting system that has been in the news lately is the stationary mirror-drum developed by Mihaly. The actual drum of small mirrors is fixed, and a rotating mirror in the centre of it, in itself a very light moving part, does the work.

We must not neglect the developments that are constantly taking place on the transmission side of the question. The photo-electric cell to-day is a very different piece of apparatus from its prototype of, say, ten years ago. This is just as well, for it may be regarded as the counterpart of the microphone.

Using Giant Photo Cells.

If the B.B.C. were to go back to their 1922 microphones to-day, it would not be amusing to any of us, but the whole point would be that half the elaborate apparatus in the transmitting station would be useless.

Similarly, any defect in a photo-electric cell would cripple the entire television transmitter. The tendency nowadays is to use one or two giant photo-cells instead of the banks of small cells that used to be popular.

"Faking" of television with photo-cells will, of course, be just as important a branch of the art as the "freak" shots with cameras in cinema work. **L. H. T.**

LIGHTNING AND LEAKAGE

How a big transmitting problem was solved.

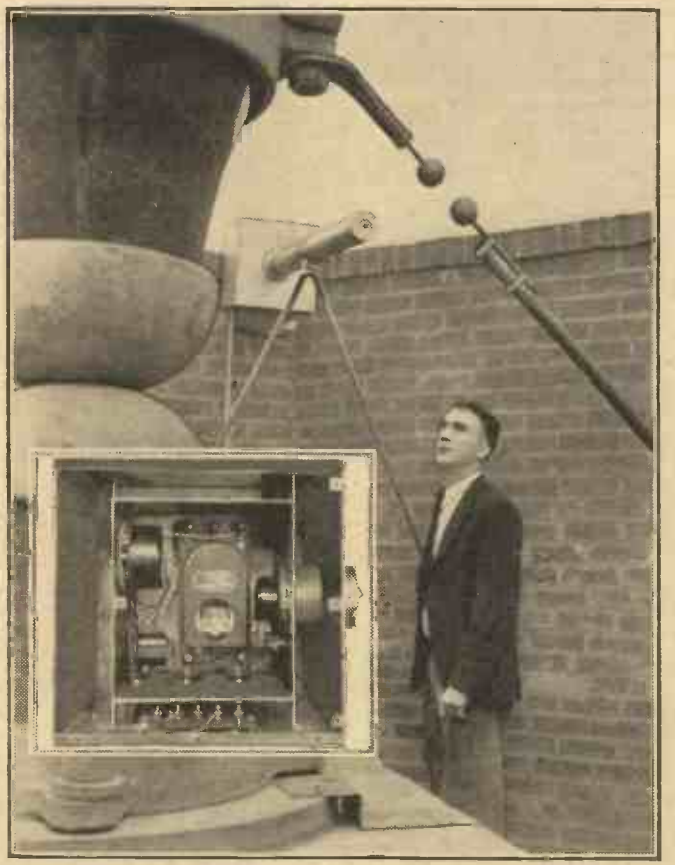
AT the base of the giant 831-foot vertical radiator steel aerial tower of 500 kw. W L W at Cincinnati, Ohio, a tiny "electrode eye" stands guard day and night protecting the radio audience against interruption in their entertainment from the station.

This photo-electric cell is the "brain" of a unique device recently developed by W L W engineers to protect valuable equipment against lightning and to prevent loss of broadcasting power through troublesome "power follow-up arcs" across the safety gap that carries lightning discharges from the tower into the earth.

A Difficult Problem.

While W L W's new vertical radiator aerial increased the station's efficiency some 50 per cent, it was soon discovered that unfortunately the huge 450-ton steel tower also served admirably as a giant lightning rod. It became the problem of the engineers to earth the electrical energy thus collected from the atmosphere while at the same time preventing the earthing of the 500 kw. power generated by the transmitter.

WATCHING THE GAP



The positions of the spark-gap and the "electric eye" are shown in the large portion of this photograph, while the interior of the box containing the photo-cell gear is shown in the inset picture.

The use of the photo-electric cell was resorted to after the ordinary method, that of providing a direct lightning path to the ground by means of a safety gap across the base of the tower, was found to be unsuccessful. In adjusting the gap it was discovered that one wider than two inches failed to provide complete protection, while with one less than two inches the normal peak voltages due to modulation on the 500-kw. carrier would, on occasion, cause discharge across the gap.

An even more serious problem presented itself when it was found that once the arc was started across this gap, either by lightning discharge or by an abnormally high voltage, the arc could not be extinguished, as power from the 500-kw. transmitter kept it "alive," draining practically all of the station's power from the aerial into the ground.

The Solution.

After various types of gaps, current transformers and rectifiers were tried unsuccessfully, the engineers resorted to the use of the photo-electric cell device. A Weston photronic cell, with its associated relays, was installed in a double shielded box on the brick wall surrounding the aerial base insulator.

A long tube containing light baffles was installed so that only light from a point directly in the safety gap could strike the photo-electric cell. The relay operated by the "electric eye" was connected in such a manner as to remove the station's plate voltage to the final amplifier whenever the photo-electric cell was excited and to reapply it the instant the arc was extinguished.

Due to the high speed of the control circuits, the interruption to service is so slight as to be barely perceptible to the ear.

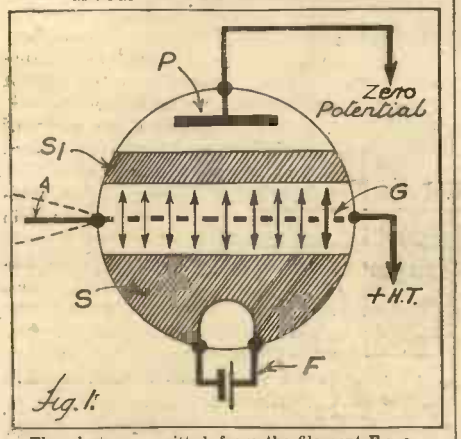
Handling "DWARF" Waves

A lucid description of what happens inside a valve at very high frequencies, and of a remarkable discovery which has made it possible to use an ordinary valve on wavelengths of even less than one metre long.

By J. C. JEVONS.

PROFESSOR CLERK-MAXWELL, whose researches paved the way to the discovery of wireless waves, had a happy knack of making difficult scientific theories seem relatively simple. For example, when lecturing to his students on the physical law which deals with the relation between heat and mechanical energy, he brought to his aid an imaginary imp or "demon" who was able to mingle with the invisible molecules of a gas and observe exactly how they behaved under the action of heat.

INSIDE THE VALVE



The electrons emitted from the filament F produce the space charge S from which the main electron stream is drawn off by the grid G. The electrons pass through this grid towards the plate P, which, being at zero potential, tends to repel them. The result is a second space charge, S1.

If we could make use of this famous little "demon" to explore the inside of the glass bulb of a thermionic valve, when it is handling wireless waves, he would find many things to report which are not visible to the ordinary human eye.

He would note, for instance, that when a valve is producing oscillations, the plate voltage is 180° out of phase both with the plate current and with the grid voltage; also that the grid voltage is in phase both with the grid current and with the plate current.

The Space Charge.

He would further see how the H.F. oscillations which appear in the output circuits are produced by the rapid passage of the electron stream through the valve from filament to plate. Actually the stream is drawn through the grid from a "space-charge" or reservoir of electrons which surround the heated filament and are continually replenished by it.

Next let us imagine that the "demon" is instructed to mark what happens inside the valve as the frequency of the oscillations is steadily increased. For some time he would observe nothing more remarkable than a general sense of speeding-up, and a growing loss of energy by capacity leakage across the electrodes.

But a point will come—somewhere in the neighbourhood of five metres—when our "demon" would have to report a general breakdown of the action of the valve, owing to the distance which separates the filament from the plate inside the valve. Short as this distance is, the electron stream takes a definite time to traverse it, and the time-factor finally sets a limit, when an ordinary valve is used in the ordinary way.

Sixty Million Times a Second.

After all, a wave five metres long repeats itself in the acrial, and oscillates through the valve, no less than sixty million times a second. Even if the total inter-electrode distance only amounts to a few millimetres the pace set gets too hot for the electrons to keep up with.

To put it in another way. The amplifying action of a valve depends upon a change in grid voltage being instantaneously reflected by a change in plate current. At a frequency of 60 million cycles a second, the electron stream tends to lag behind in its reaction to this enormous speed. Instead of changing simultaneously, the grid and anode voltages begin to fall more and more out of step, until the valve simply starts to act as a shunt condenser and ceases to function as an amplifier.

This happens, it should be noted, when an ordinary valve is used in the ordinary way—that is with a high positive voltage on the plate and a small biasing voltage on the grid.

Some time ago two Germans named Barkhausen and Kurz made the remarkable discovery that the same valve can be given a fresh lease of life—so that it is able to handle waves even less than 1 metre long—by adopting the simple plan of changing over the plate and grid voltages.

That is to say, a high positive voltage is applied to the grid, instead of to the plate, and the latter is left at "earth" or filament potential. This apparently simple change completely alters the way in which the ordinary three-electrode valve functions.

The electron stream no longer follows the usual path between filament and plate, but instead dances about at a tremendous frequency over a much shorter path quite close to the grid. Each time it cuts across the grid a high-frequency current is induced in a dipole aerial which is connected directly to the grid terminal.

Because of the shorter path through which the stream moves, the time-factor is no longer fatal, and the valve can be used either to generate or receive waves only a few centimetres long.

Investigating The Position.

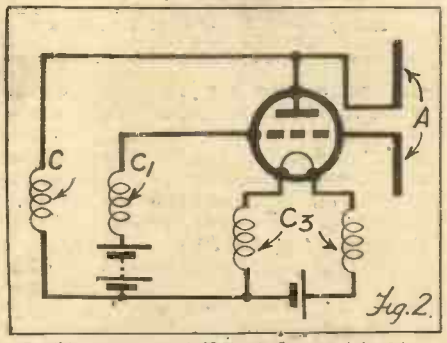
Could we again make use of our friendly little "demon" to investigate the position inside a B—K valve under the new conditions, he would report a state of affairs somewhat as indicated in Fig. 1. The electrons emitted from the filament F first group themselves around the heated wire to form a "space-charge" or reservoir S, from which the main electron stream is drawn by the highly-positive grid G.

The stream shoots forward towards the positive grid, but since the latter is an open spiral wire, only a comparatively small number are absorbed by it. The rest pass through towards the plate P, which, being at zero potential, tends to repel instead of to attract them. In this way a second space-charge of electrons accumulates in the space marked S1 between the plate and the grid.

This second space-charge acts as a

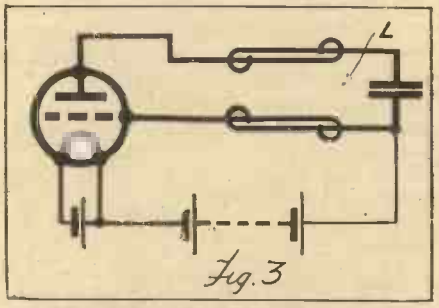
(*Continued on page* 438.)

A TYPICAL SCHEME



In this arrangement H.F. chokes are joined in series with the L.T. and H.T. batteries. A is a dipole aerial.

ALTERNATIVE METHOD



A scheme in which the dipole aerial is replaced by two telescopic leads L forming a Lecher-wire radiator.

Even the kitchen attached to the dining-car was invaded by the radio reporter, and here we see the chef "saying his piece" into the microphone.

RECORDING ON AN EXPRESS TRAIN

How a complete travel-programme was made on a train without impeding the running to time-table at all.

THE use of disc recording for the purpose of supplying background noises and local colour to broadcast programmes has long been a recognised fact, but there are some places where the gramophone disc cannot well be used for the purpose.

The System Employed.

One of these is on a fast-moving train, where the swaying of the coaches prohibits the use of such a method of recording.

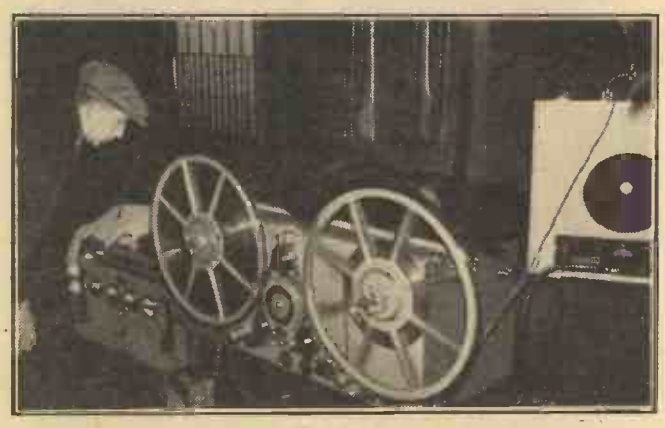
An interesting series of records was recently taken on the "Rheingold" express (which runs from Holland to Switzerland) when the Cologne broadcasting station wanted a special record of train noises and experiences for one of its programmes.

The system of recording used was that developed by the C. Lorenz Company, and which uses a steel tape instead of the wax disc. Sound vibrations are converted into A.C. impulses which are passed through electro-magnets placed close to the moving band. These introduce a series of varying magnetic fields which are made permanent by the steel band and which can be reconverted into sound by passing the band past another set of electro-magnets in the reproducer.

Special portable types of recording gear were employed, and the whole of the apparatus was shipped aboard the train during its eight minutes' stop at the frontier between Holland and Germany. Then during the run to Dusseldorf, where the commentators boarded the train, the apparatus was rigged up in the luggage van and the necessary microphone lines for the portable microphones were laid.

From Dusseldorf onwards the commentators had a busy time, running to and fro, in the train interviewing the engine driver and recording his personal opinions and impressions, making a record of the noises, of an interview with the cook in the kitchen, and even of talks with some of the passengers.

THE STEEL-BAND APPARATUS USED



Due to the movement of the train, ordinary wax-disc recording could not be employed, so this gear, working on the same principle as the Blattnerphone used by the B.B.C., was called into service.

An Interesting Broadcast.

A comprehensive recording of the whole journey up to just before Mannheim was made, and at the latter station the gear was unshipped and removed from the train during a six minutes' stop.

On leaving the train the apparatus was loaded on to a tug, on which more recording was carried out, making a long sound travel-programme of unusual interest which was broadcast from Cologne on the following day. **A.G.**

THOSE RADIO ADJECTIVES

Some of the different terms used to describe radio reproduction.

THIS short article deals only indirectly with wireless. To be exact, it deals with wireless terms.

Who has not heard a class of reproduction which is spoken of as being "woolly"? This means that it sounds as though it were being heard through a mass of cotton-wool, one supposes. "Muffled" is fairly common, as is also "blurred," and I have heard the term "muddy" in this connection. "Dirty" describes something which is simply awful.

"Would Sterilise Milk."

On the other extreme, we have "shrill," "squeaky," "piercing," and I have heard it said of a soprano that she "would cut you open," or "stove in your ear-drums," or again (this time by a scientific friend), that her voice "would sterilise milk."

Nicely balanced reproduction is "just right," or "nice," or "O.K." "Perfect," "lovely," "great," are other examples of this class. When the quality is unusually good, or someone has just bought a new set, or fitted new valves, or bought a new loudspeaker, it is described as "magnificent," "superb," or "gorgeous," and I have heard a proud owner say that if he let his set go all out it "would blow the roof off."

Technical terms come in for a good deal of mishandling, but the few examples I have quoted should do to be going on with.

W. N.

A TURN OF THE SCREW

How a small item can make a major fault and be no end of trouble to trace.

SOUNDS like an old-fashioned thriller, doesn't it? I can assure you it was all too thrilling for me. The trouble was I had promised the loan of a set to a friend, and he was calling back in three-quarters of an hour to carry it off to his abode—some ten miles distant.

When I had put my spare set away, after treating it to a couple of first-class "Sensity" coils, it was really delivering the goods. No one could have wished for a better or louder outfit. You will scarcely believe me, but when I hooked it up on the table, purely as a routine precaution, the medium wavers were shaky, while Droitwich—the great Droitwich—had vanished, clean vanished.

It was a facer, I can tell you. No improvement by hooking the aerial on to the plate lead of the S.G. valve, though this at least narrowed things down to the rear of the set. So I whipped "Sherlock" out of his box and proceeded systematically. Current consumption normal. Transformer, L.S. and output choke in order. Condensers all sound. Reaction good. Possibly the anode coil? No break in the long-wave winding; in fact, coil quite O.K.

Lacking an Earth.

Then, just as I was taking the testing prods away, a small projection caught my eye. A little brass screw with its head reared high in the air. A closer look and the mystery was solved. A few turns of the screw and the coil was once again well and truly earthed.

Which only goes to show that a little thought before action is priceless. A break in the long-wave section or a faulty earth should have been obvious from the start. While I, like a fool—— But there, never mind, we all learn by experience.

E. O'M.

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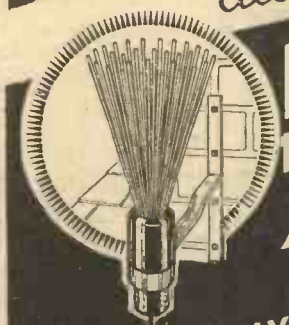

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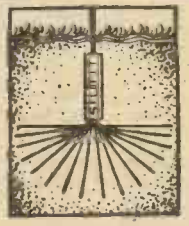

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THE LINK BETWEEN

By G. T. KELSEY.

FROM what I can gather around the trade, there appears to be a tremendous amount of "secret" activity at the present time in connection with high-definition television. But very few people, it would seem, have yet given much serious attention to the manufacture of special components for the ultra-short wave reception side of the question.

Well, I suppose there is still time, but it will be rather an ironical situation if, when the new programme service commences, the listener, or perhaps I had better say the "looker," is able to obtain the actual vision part of the apparatus but not the components from which to build a set for reception.

In this connection the beginnings of the television era differ from the early days of broadcasting inasmuch as it was possible in those days to tell listeners how to make their own components. But ultra-short-wave reception is an entirely different pair of shoes, and it is very doubtful indeed whether it will be possible to pursue a similar course this time.

Now that the Television Advisory Committee has given us something definite on which to work, let us hope that it will not be long before the manufacturers provide us with the first fruits of their endeavours.

The two things that are most urgently required are coils and intermediate-frequency transformers with a suitable band width, and I shall be very glad indeed to pass on to "P.W." readers any news of activities in this connection.

But please, Mr. Manufacturer, let us be hearing soon, for we constructors want to be in right on the ground floor.

"Noise-proof" Aerial System.

My views on "man-made" static—and the menace that it constitutes to the enjoyment of broadcast programmes—will be apparent to all of you who follow my notes. I have always regarded it as a very serious matter indeed, and one for which there can be no complete solution until such times as legislation is introduced to prohibit the installation of any electrical apparatus that is capable of causing interference with radio.

When I say "complete solution" I mean, of course, on a country-wide basis. Actually, there are many complete solutions for individual cases where the listener is himself prepared to take steps to abate the nuisance, and an outstanding accessory in this connection is a device known as the Goltone "Statoformer."

This consists of two highly efficient transformers—one of which is attached to the aerial and the other to the set—which are linked together by a special shielded down-lead termed a "Statolead." Experience tends to show that a great deal of "man-made" static interference troubles are picked up on the down-lead to the set, and with this device of Ward & Goldstone's the difficulty is easily overcome *without loss of signal strength.*

Those readers of "P.W." who may be enduring interference trouble which ceases, or almost entirely ceases, when the aerial is disconnected from the set, would be well advised to obtain further details of this ingenious device.

It is probable that your local dealer will be able to provide you with a leaflet, but, failing that, drop a line to Messrs. Ward & Goldstone, Ltd., Pendleton, Manchester, asking for a copy of their leaflet "Pop. W. Stat/43520 F." It shows the whole thing diagrammatically.

Released this Week.

The G.E.C. is prominently in the news this week with an entirely new battery-operated S.G. three-valve receiver which, as far as I can judge from the details available at the time of going to press, is one of the most attractive battery designs that has yet been produced.

That's the sort of news that makes me "purr," for until comparatively recently I felt very strongly that manufacturers generally had not given all the attention that they might have done to the requirements of listeners without mains.

But it is a fact that there has been a most noticeable improvement in this state of affairs during the last twelve months or so, and with the advent of this latest G.E.C. design—which was released on Monday last—battery users are extremely well catered for.

I intend to give you some further details of this fine set as soon as I can obtain them, but in the meantime may I tell you that the outstanding features are high efficiency, low H.T. consumption (of the order of 9 to 10 milliamps), first-class quality of reproduction (a moving-coil speaker is incorporated) and, what is perhaps of even greater importance, low cost.

The set, complete with batteries, costs only £7 19s. 6d., and it is self-contained in the sense that all the batteries are housed in the cabinet.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos. Every care will be taken to return M.S.S. not accepted for publication. A stamped, addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

FITTING A PICK-UP TO THE MODERNISED "MAGIC."

S. C. (Caterham Valley, Surrey).—"I must write to say how pleased I was to find that you had remembered the needs of the old 'Magic' users in the May 4th 'P.W.' Without minimising the wonderful sets we have had since, I still feel that the 'Magic' was so far ahead of its time that it is still one of the very best propositions in radio.

"By bringing the most famous set of the past up-to-date you have enabled the not-much-to-spend brigade to feel they are not left behind. And I am sure there must be many who would, like myself, like to go just one step further—gramophone.

"So what about the details for fitting a pick-up to the modernised version? Where should the switch be placed? And the terminals?

"Also, knowing what a bad reputation pick-up wiring has for introducing hum, etc., can you say whether screened wire will be necessary?

"I have been tempted to try it for myself with a Bulgin type 86 switch, but the modernised set is so good that I do not want to interfere with it unless I can be sure of working on the right lines. Please say if this switch would be O.K., and if so, where it should be placed in the new model."

Owing to the "Magic's" ever-green popularity the question of fitting pick-up terminals was borne in mind when modernising the set, and consequently the design readily permits of this modification. But, like all additions, the wiring for pick-up connections needs to be done carefully, and should not be regarded as something which can be "done anyhow," in an odd moment.

What you need is the pair of terminals for the pick-up leads, a suitable switch, and leisure to do the job thoroughly; and, given these, the usual care to keep the leads short, and a minimum of interference with the existing arrangement of the set.

The type of switch you name is suitable, and we suggest you mount it on the front panel so that the all important grid lead from V2 can be kept short, and direct.

On either side of the switch arrange to mount one of the pick-up terminals—not necessarily at the same level as the switch, but higher, or lower, if preferred.

Drill the hole for the switch directly under the second ·0005-mfd. condenser. Undo the wire that is at present fixed to the G terminal of the V2 valve holder, and connect this valve-holder terminal to the slider terminal (the centre one) of the switch.

By the way, the switch is better mounted with terminals upwards, where they can more easily be reached.

From the ·0003's terminal that was formerly connected to G. on the valve holder (and is still connected to the grid leak) take a wire to the "Radio" terminal of the switch. (This will be the one that is behind "Gramo." on the indicating plate, when the switch has been mounted terminals uppermost.)

Turning the switch to "Radio" will now restore the former circuit, by joining the grid terminal of the valve holder to leak and condenser as before.

From the remaining switch terminal a wire must be taken to either of the pick-up terminals, the one nearer the "Aerial S.W." terminal being preferable. The other pick-up terminal carries a flex lead, which must be plugged into the 1½ volts — tapping on the grid bias battery. (Keep this lead down close to the panel-and-baseboard corner, because if it is allowed to stray you may get unwanted interaction.)

CUTTING OUT THE S.G. VALVE FOR LOCAL RECEPTION.

C. C. H. (Tollington Park).—"My three-valver is more than a set—it is, I fear, a bit of an extravagance! We cannot really afford such a beauty, but having got it and enjoyed its B.B.C. and foreign programmes we would rather 'cut down' on almost anything than let the set go.

"To keep its battery cost down as low as ever it can be kept I have been scheming to cut out the S.G. valve (not a multi-mu type) when listening to the local station's programmes, which are the ones usually tuned in. But I am not sure if it is right to break the filament lead to the S.G. with a switch, or whether I ought to take the S.G. valve right out to save H.T. as well.

"Also, would it be right to take the aerial off the aerial terminal, and place it on the detector grid condenser, which I am told will enable me to cut out the S.G. stage, in effect?

"In general, is there any objection to such a change-over provided it is done carefully? And would you think it worth while in the circumstances?"

In the ordinary way it is hardly worth bothering to cut out an S.G. valve unless it is *certain* that the set will be quite adequate to give *good reception* without that valve during the greater part of the time that the set is in use. That is to say, the scheme is worth while only if the local station's programmes are really *good* without the S.G., and the local are the only programmes wanted five days out of six. When these conditions apply the following method may be adopted satisfactorily.

Modifications to be Made

The necessary changes are of a two-fold nature: (*a*) the transference of the aerial to the detector, from the S.G. input circuit; and (*b*), the switching off of the S.G. filament supply.

To meet requirement (*a*), all that is necessary is to fix a new "Aerial" terminal to some convenient place near the detector tuned circuit, and connect this new terminal, via a small fixed condenser to the "fixed vanes" wiring of the detector tuning condenser. The fixed vanes terminal itself, the corresponding coil terminal, or the grid condense terminal that is connected to these points are all appropriate places from which a wire can be run.

To meet requirement (*b*) it is sufficient to break, by means of a conveniently accessible switch, the connection between one of the filament terminals of the S.G. valve holder, and the wire (or wires) which go to it.

In effect, this means mounting an ordinary on-off switch near the S.G. valve holder, and connecting one of the filament terminals of this valve to the switch, and the other side of the switch to the filament wiring of this valve, instead of taking the filament wiring direct to the terminal in question.

To change over from "S.G. in use" to "S.G. off duty" positions, the aerial is first removed from its correct terminal, and placed instead on the new "aerial" terminal. This brings the aerial's input to the detector circuit.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS & ANSWERS

(Continued from previous page.)

Then the new filament switch may be "opened," which cuts off the L.T. current to the S.G. valve, leaving the other valves connected to the accumulator as usual.

There is no need for an H.T. switch as well, since the removal of filament current from the S.G. will automatically stop it from taking any H.T. current from the battery, though the valve remains in position in the switched-on set.

THE NEED FOR RE-TRIMMING.

A. S. (Luton).—"This question of re-trimming seems to be less simple than is often supposed. I always believed that once a set was properly trimmed, it was trimmed—and that was that! But how do you account for this experience?

"My cousin owns a set similar to mine, and when visiting me he affirmed that his set was about twice as good on distant foreigners as mine, and he believed mine wanted re-trimming. It was still locked on all trimmers, and I am certain that the condensers were still as originally set, but I let him alter them one at a time, to prove to him that he was wrong.

"On the first and second circuits he had to return to the original trimmer setting to get maximum strength; and I was just beginning to crow when we found that the third circuit (detector's grid) needed quite an appreciable reduction in the trimmer setting for best strength.

"As I am certain that the adjustments had never been disturbed till then I am forced to conclude that sets may need re-trimming after they have been in use for a time. If so, why is it so often said that once the makers have set the trimmers they should not be interfered with?"

You stress the fact that the trimmers had not been re-set since the set had been in your possession—but *should they have been?*

We ask this because there are times when a set definitely needs testing for trimmer adjustment; and if such re-adjustment is not carried out the loss in sensitivity may be considerable.

It is true that generally the boot is on the other foot, and *unnecessary re-trimming* is the cause of lost programmes; but that does not mean that *necessary re-trimming* can be neglected.

If you change one of the valves concerned, or if you modify the associated circuit in any way (such as by the insertion of radiogram switching, or alteration of components), re-trimming may be necessary. Probably you overlooked this fact—and it is now being proved, once again, that it cannot be overlooked with impunity.

CAUSE OF RUN-DOWN BATTERIES.

G. N. (Nuneaton).—"I got rid of the hum, as you suggested, by putting an old transformer (H.T.+ and P. terminals) in the detector H.T.+ lead, with a 2-mfd. condenser between the set's L.T.— terminal and the —P terminal. Total cost, nil, and the hum cured. But my batteries seem to use up quicker than before.

"Also, I notice that the milliammeter shows a small reading (about one milliamp) when the set is switched off, unless I disconnect the new arrangement, when the needle goes back to 0 as before. Is this right?"

No. You could not have a plainer indication of leaky insulation. That old 2-mfd. condenser is a dud, and should be scrapped in favour of a new one, after which the milliammeter needle will show the correct zero reading if the set is switched off. Never allow the milliammeter to show a reading (current passing) when the L.T. is switched off. It is a sure sign of a fault in insulation, and the usual offender is a defective condenser.

THE COMPLETED A.I.F. ASSEMBLY

This photograph shows the A.I.F. Assembly, fully described on pages 419 to 421, ready to switch on. It works without any external connections whatever.

VARIABLE-MU CONTROL AT A DISTANCE.

W. F. (Croydon).—"Following a 'P.W.' hint I can control the volume from the other end of the room, by mounting the variable-mu resistance on a three-wire extension. It only took twenty minutes to rig up, and goes fine, except for a bit of hum. Any way to remove this?"

You do not give us many particulars, W. F., do you? Is the hum there all the time, irrespective of the lead's position? You may be running it too close to other wiring, but a screened extension lead would obviate that.

And are the potentiometer leads well by-passed? If not, a '1-mfd. condenser across its "outers" (at the set end, of course) would help. And another condenser from slider to earth may be advantageous.

LISTEN FOR THIS

Dear Sir,—I have recently received an intimation from Mr. S. Gordon Taylor, one of the Editors of the American wireless magazine "Radio News," to the effect that W C A U (1170 kc/s., 50 kw.) and its short-wave counterpart W 3 X A U (6060 kc/s., 1 kw.) are dedicating a special programme to the members of the "DX" Corner of "Radio News," timed for 7 a.m. B.S.T. on July 2nd.

While it is unlikely that W C A U will be audible at this time, and particularly owing to the adverse atmospheric conditions prevailing at present for medium-wave long-distance listening, it seems probable that short-wave listeners will have a good chance of hearing this special broadcast.

C. K. McCONNAN.

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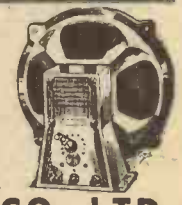

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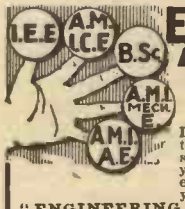

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ON THE AIR

(*Continued from page* 422.)

I am glad John Morgan has been kept on to do another series of farming talks. Although he set himself a very high standard in his last series he should easily maintain it in the present, seeing that he has been on the Continent recently delving into Continental methods of farming. Though Mr. Morgan's talks are of no practical use whatever to me I find them strangely interesting.

* * *

The Aldershot Tattoo (Pt. I) broadcast was very similar to previous Tattoo broadcasts. Massed bands, especially when brass is prominent, come through extraordinarily well. I am never one to go mad over the skirl of the pipes. Brass bands are different. The best and most impressive piece they played was, I thought, the Quick March—"The Royal Standard" by Keith. The rest seemed too familiar to excite amazement.

* * *

Alarmist tendencies, I notice, sometimes creep into B.B.C. news paragraphs. In a report of the recent German factory explosion the number of fatalities was given at somewhat in excess of those, presumably authentic, that appeared in the next morning's papers. It will be unfortunate if B.B.C. news reports have to be taken *cum grano salis*.

* * *

Another item amused me. It concerned the position of the boats on the river at Cambridge as a result of the first day's racing. The boats at the head of each division were announced in a most congratulatory tone. The amusing part of this announcement was that one of these distinguished boats had achieved the distinction of being relegated from a higher division—the result of being bumped.

* * *

Sir John Reith is disappointed with the way local education authorities have responded to the "Talks to Schools." Excellent though these talks are, I have always felt that there is little in them to help the average secondary and public schoolboy to get through his Matriculation or School Certificate examination. I am convinced that a good deal could be done with these examinations in view. May I suggest, for instance, a series of lectures on a period of literature (English, French or German), another course on History (English, European, Roman) which would satisfy the requirements of the syllabus of the Matric. or School Cert. examinations? Provided these lectures were given by experts there is no doubt in my mind that they would be regularly listened to by thousands. If a start were made with the two subjects I mention I predict that in future years the scope would have to be extended.

C. B.

AMERICANS LIKE BIG SETS!

(*Continued from page* 425.)

use more valves of a relatively lower effectiveness, and there is much to be said in favour of this practice if the valves can be sold at a low price.

Even so, it must not be thought that a performance equivalent to that obtainable with the above-mentioned 23 or 25-valver is possible with a mere handful of British valves. Those sets do represent very advanced radio engineering, and American listeners are fortunate to be able to buy them at competitive prices.

On the other hand, it is possible that few British listeners desire to operate their sets at the great volume levels for which the big American multi-valvers are designed.

G. V. D.

HANDLING "DWARF" WAVES

(*Continued from page* 433.)

"virtual" cathode—similar to the one formed in the pentagrid converter when used as an "electron-coupler" in a superhet set. As electrons are drawn from it by the highly-positive grid, some of them are absorbed and pass out into the aerial, whilst the rest shoot through and go to rejoin the lower space-charge S.

In this way, when worked in the Barkhausen-Kurz fashion, the usual discharge stream through the valve is replaced by a continuous to-and-fro "dance" of free electrons across the grid. The path is so short and the motion so rapid that the valve will now handle wavelengths barely one-sixth of a metre long—corresponding to a frequency of nearly two thousand million cycles a second.

Figs. 2 and 3 show typical Barkhausen-Kurz circuits. In Fig. 2 the H.T. and L.T. batteries are protected by chokes C1, C2, C3, and the resulting oscillations are fed to a dipole aerial A connected directly across the grid and plate terminals. In Fig. 3 the dipole aerial is replaced by two telescopic leads L forming a tuned Lecher-wire radiator.

It is interesting to note that the B—K valve generates sustained oscillations without the use of any direct reaction or ordinary back-coupling. When used in reception the incoming waves are combined with the locally generated oscillations, and the valve then automatically rectifies the "excess" signal energy.

ONE GUINEA FOR A LETTER!

AN INVITATION FROM THE EDITOR TO "P.W." READERS

I WANT readers of "P.W." to help each other. I want them to use the columns of this paper to express their views on all and every aspect of the great hobby of radio; I want them to "swap" experiences; I want them to tell about their triumphs—and their failures—with the various sets they have built. I want, in short, to encourage an exchange of views, opinions, likes and dislikes. . . .

Send me letters for publication, in order that "P.W." can become, more than ever, the best medium for imparting all kinds of knowledge about radio.

YOU must have had, many and many a time, interesting experiences when building or operating your set. Tell other readers about your radio experiences. And, incidentally, get to know each other through the medium of "P.W."

For the best letter each week I am offering a prize of one guinea. Send your letters to the Editor, "Popular Wireless," Tallis House, Tallis Street, London, E.C.4.

TWO VALUABLE ITEMS

Details of a three-position switch and a magnetic-needle instrument for experimenters.

A MULTI-CONTACT SWITCH.

MESSRS. BURNE-JONES & CO., LTD., have sent us a multi-contact switch which has been designed for use in battery sets and which embodies three sets of contacts.

The switch works with a reliable cam action, and one of the three cams is so shaped that its associated contacts remain closed while the other two pairs are being switched.

In other words, the switch is of the three-position type. When the knob is hard over in an anti-clockwise direction all the contacts are open. In the second position all three close. In the third position two of the pairs open and the third remains closed.

An obvious use for this switch is, therefore, as an on-off and wave-change control, the movements corresponding with "Off," "Medium" and "Long."

The switch is substantially constructed and the contacts break to the extent of nearly a quarter of an inch, there being negligible self-capacity. The action is easy but extremely definite, and no "half-way" positions are possible. This desirable feature is achieved by means of a simple but most effective mechanism which is obviously able to stand up against an indefinite amount of usage.

THREE POSITIONS

Extremely useful switching combinations are obtainable with this Magnum switch.

A knob of generous dimensions is provided, and the switch can be mounted on a panel by means of one hole.

The contacts are of nickel and silver and have a definite self-cleaning movement. The switch retails at 2/6, and we consider it to be very good value for money. It is also available with gold and silver contacts, and there is also a special short-wave type.

We should perhaps mention that it is not fitted with terminals, so that it demands soldered connections.

A USEFUL GADGET.

BY means of a compass and a few turns of wire it is possible to make a useful galvanometer for indicating current flow. And if the means are available it can be calibrated to give fairly close readings.

The same idea can be adapted to methods of visual tuning, and, indeed, there are quite a number of things to which such simple and easily assembled apparatus can be put by the ingenious constructor.

In this connection Messrs. Leslie Dixon and Co., of 218, Upper Thames Street, London, E.C.4, are offering compasses in brass cases and with bevelled glasses at the low price of 9d. each. It should be noted that these "compasses" do not show actual compass bearings.

A PLAIN COMPASS

Experimenters should find many uses for this little compass which is provided with a plain dial.

The needle is approximately two inches in length and is sensitively suspended. There should be many constructors who will find the compasses of interest and use. It should be noted that they are of particularly robust construction and it is impossible for the needle to stick or come adrift as in the case of many cheap compasses, that is, of course, unless the glass is broken.

TECHNICAL JOTTINGS

Some Varied Notes of Interest to all Readers.

By Dr. J. H. T. ROBERTS, F.Inst.P.

WHEN all-mains receivers were introduced a few years ago, for some reason or other the D.C. people were not nearly so well catered for as those on A.C. Perhaps it was that the D.C. folk were in the minority, and perhaps that, technically, it was much easier to make an A.C. all-mains set than a D.C. one, owing to the great facility with which A.C. can be stepped up and down in voltage. However that may be, those on D.C. have for a long time felt that they were rather neglected, and, in fact, even when a D.C. all-mains set *was* available, it did not seem to come up to the same standard of performance as many of the better class A.C. receivers.

Latterly, however, all this has been to a large extent remedied, not merely by improving the catering for the D.C. people, but by the much better method of bringing out universal A.C./D.C. sets.

"Changing Over."

As you know, under the "grid" scheme for the electrical supply throughout the country there are continual change-over arrangements going on, involving first one district and then another, changing over from D.C. to A.C., or from one voltage to another. A slight change of voltage on A.C. is not a very serious matter; probably it will not make any noticeable difference to the performance of an A.C. set and, even if it does, it can quite easily be put right by the use of a small power transformer to supply the mains input to the set at the right voltage. Where a change-over is made from D.C. to A.C. however, it becomes a very serious matter for the owner of a "D.C. only" set. It means, in fact, that his set is useless, and either he has to have it modified, at a good deal of expense, or, more likely, he has to buy a new one. The fact that the electric supply authorities make some sort of arrangement with him in the matter does not alter the fact that the arrangement is an uneconomical one.

A Step in the Right Direction.

The introduction of really efficient universal A.C./D.C. sets therefore is undoubtedly a step in the right direction, because in this arrangement you can buy an all-mains receiver, confident in the knowledge that if you are on D.C. and the authorities come along and change you over to A.C., everything goes on just the same, whilst in the possible event of your moving from one house to another where the electric supply is of a different character, the same continuity of service is assured.

Television Lamp Improvements.

In low-definition television reception it is very common to use some form or other of neon lamp, or at any rate a discharge lamp, and in lamps of this kind there is a tendency for the brightness to diminish gradually over a period, owing to the fact that the metal of the cathode vaporises or disintegrates and is deposited upon the interior surface of the glass bulb. You will notice this effect often enough in an ordinary radio valve which has been used for a long time, or in a metal-filament lamp which has gone "bust"; there is a definite blackening of the glass due to the deposition of the metallic film.

Using a Silver Cathode.

In order to get over this defect in television lamps, a new invention has been introduced according to which the anode is made large enough to screen all the part of the glass bulb remote from the cathode, whilst a central hole is provided in the anode through which the glow of the cathode can be seen. Behind this hole is placed a metallic mirror set at an angle; the cathode is made of silver. The result is that the metal vaporised or sputtered from the cathode deposits itself on the surface of this mirror, which is maintained clean and bright. The glow on the cathode is seen, as already mentioned, through this inclined mirror, and the glass in the region of the mirror is protected from blackening by the large anode.

An H.F. Valve Hint.

Most H.F. valves have hitherto been made with screw terminal caps, but lately H.F. valves have been put on the market which have plain bosses instead. It may be worth mentioning that the plain cap is connected to the lead-out from the valve by a soldered connection. You should not, therefore, attempt to solder an outside lead to the metal cap, as it is quite possible that when applying the heat to it to solder the lead on you will at the same time unsolder the inside lead. I have known this to happen in more than one case.

There are special connectors provided for making connection to these metal bosses and these connectors, or at any rate some method which does not involve solder, should always be used.

"Potted" Television.

I mentioned in these Notes the other day the possibility of recording sound and vision on a gramophone record by means of a double track, one track carrying the sound signals and the other the television signals. Personally, as I previously said, I do not see very much field for this sort of thing, because it seems to me that the recording of television signals on to a gramophone record, and then picking them up and passing them through the television set, is going a long way round to it. It cannot compare, for results, with a small home cinematograph film, which nowadays is very convenient to handle. However, the rumour persists that "potted" television,

(Continued on next page.)

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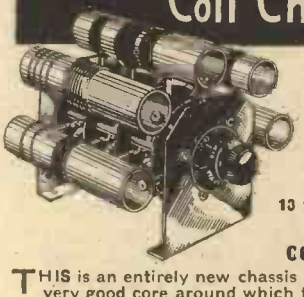

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TECHNICAL JOTTINGS

(*Continued from previous page.*)

in the shape of records, will be an important feature of home entertainment in the near future.

Useful for Testing and Experiments.

There is one use to which this arrangement can be put, however, more particularly in the early stages of television, and that is for the purpose of providing a programme, or for test purposes, at times when no programme is being radiated from the B.B.C. —I mean television programmes, of course. No one knows yet for how many hours per day, or how many days per week, the B.B.C. will send out television programmes. I suppose it is presumable that in the early stages they will not be radiated for anything like the same number of hours as the ordinary sound programmes.

Therefore there will probably be plenty of blank periods when dealers, for example, may want to demonstrate television sets or when experimenters may want to experiment, and some form of potted television will no doubt meet the case very well.

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When No Programmes Are Radiated.

But beyond something of this kind I do not see the same field for potted television as that which exists for potted or recorded sound. The two seem to me to be in entirely different categories, and to my mind the way to "store" vision is by means of a film.

However, the advent of television will be full of interesting technical possibilities, and it is not safe for any of us to be too precise in predicting what is going to happen in the near future.

Interference Suppressors.

The use of interference suppressors for radio receiving sets is now increasing so rapidly that the Institution of Electrical Engineers and the Radio Manufacturers' Association and certain other electrical authorities are giving this matter careful attention from the point of view of the safety rating of the components used, and a Report on this question has lately been issued. It is pointed out that a condenser, for example, which is tested at only 500 or 750 volts D.C., used in an interference suppressor, may be quite unsuitable where the circuit is liable to, say, 1,500 volts alternating current between terminals and earth. An A.C. voltage of 1,500 will be equivalent to some 2,250 volts D.C., so far as peak voltage on the A.C. is concerned, and therefore the test should be either 1,500 volts A.C. or 2,250 volts D.C. The Report recommends that the test with A.C. should be continued for at least one minute; this time is probably sufficient, and it is inconvenient to make it longer owing to the fact that the high voltage A.C. may damage the condenser.

Safety Precautions.

Although these new recommendations are very useful from the point of view of safety (which is all important), they involve the use of larger and more substantial, and consequently more expensive, components than would ordinarily be used in a standard radio receiver.

In a portable appliance of any kind, which is not directly connected to earth, it is recommended that neither terminal should be connected to the framework through a condenser having a larger capacity than one-hundredth of a microfarad. You will readily see that if a large-capacity condenser is connected between terminal and casing, there will be a correspondingly greater danger of shock in the event of a person touching the case whilst accidentally earthed.

Care in Choosing.

The Report also recommends that "Interference suppressors shall be protected by separate fusible cut-outs against the break-down or overload of any component, except when the suppressor is built into and forms an integral part of an appliance, or when the suppressor is so designed that it can only be used in sub-circuits which are already protected by fuses of a sufficiently low rating."

The interference suppressors at present manufactured by certain of the leading radio manufacturers conform to these requirements, but in buying anything of this kind you should make sure that it is one of those which is guaranteed to be suitable.

SOME INTERESTING COMPONENTS

Additions to the amazingly comprehensive Bulgin range.

THE new Hivac "X" type midget valves are fitted with bases similar to those which were used in the Weco valves, which will now be remembered only by those readers whose radio experiences date back a good many years.

Obviously, it would have been impossible to adapt the Hivac Midgets to the standard type of holder, for the simple reason that the dimensions would be absurdly out of proportion. Therefore, a special Midget holder becomes necessary, and Messrs. A. F. Bulgin & Co., Ltd., ever enterprising, are already able to supply one.

It is, as is fitting, an extremely neat little component not unlike a small bayonet type of lamp-holder. This is, incidentally, a most satisfactory principle, for the valve is easily slipped in, yet is held securely and good contact is assured.

The Bulgin holder is made from black bakelite, and is provided with nickel-silver leaf springs which are rigidly riveted in place. These springs are continued to form soldering tags.

The holder can be either panel or chassis mounted. The retail price is 1s.

Messrs. Bulgin have also introduced an Edison Screw Holder for lamps, barretters, fuses, etc. The "E.S." holder is an alternative to the bayonet type, which is more commonly used for lighting fittings. The bayonet type is a very convenient one, particularly for domestic purposes, but it is not desirable to use it with lamps of the higher wattages.

FOR THE NEW VALVES

On the left of this photograph is the Bulgin holder for the new Hivac midget valves, while to the righ is a seven-pin adaptor which enables a break in the circuit of any socket connection to be obtained.

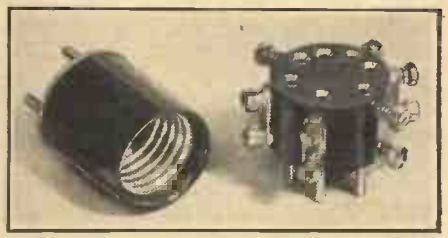
The "E.S." type provides a better separation of poles and much smaller possibilities of accidental short circuits occurring. But this is rather by the way, for, as Messrs. Bulgin state, it is because of the numbers of barretters which are now available having "E.S." caps that there is a real need for this new component of theirs.

It has 4 B.A. connecting and fixing stems, and the ends of these can just be seen in the accompanying photograph. Bushing washers can be obtained from Messrs. Bulgin if it is desired to mount the device on a metal framework. The price of the holder is 2s. 6d., and we should imagine that many constructors and experimenters will find it very useful indeed, not only in connection with the use of barretters, but also for use with lamps in charging and other circuits.

Handy Adaptors For Experimenters.

Other extremely useful Bulgin lines are the A.18 and A.19 adaptors. The A.18 is a "Seven-Pin All-Split" adaptor. The experimenter will find this an invaluable gadget. It is used in this way: the adaptor is plugged into any seven-pin valve holder in a set, and the valve which has been removed to make way for it is, in its turn, plugged into the adaptor.

TWO USEFUL HOLDERS



Here are two more Bulgin introductions, a holder for "E.S." type lamps and barretters, and a Continental type "Seven-Pin All-Split" adaptor similar to that in the first photograph.

There are six pairs of terminals on the adaptor, and these are normally joined by means of small links. Any of these links can be removed so that you can break into series with the connections to any of the valve pins in order to test anode and heater currents, connect pick-ups or mikes into circuit, and so on.

The A.19 adaptor is a Continental 6/7-pin all-split type of similar design. The price in each case is 3s.

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By

JOHN SCOTT-TAGGART

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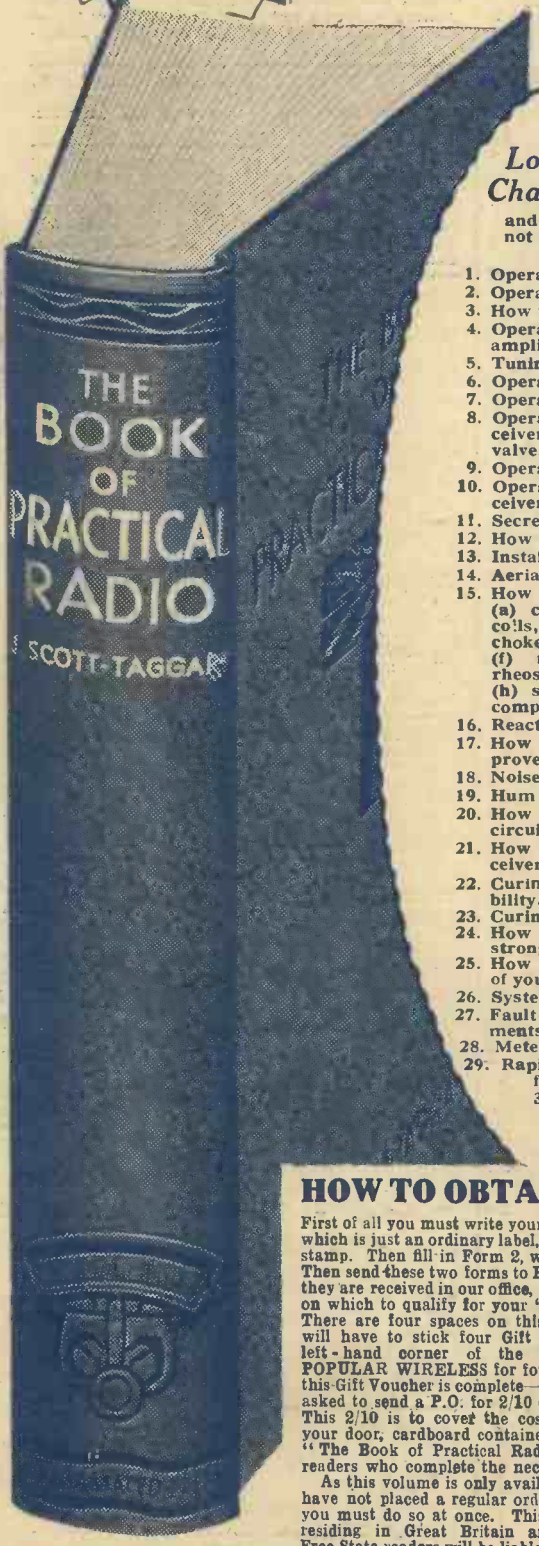

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6. Operating ganged receivers.
7. Operating tone control devices.
8. Operating double reaction receivers which use a variable-mu valve.
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10. Operating superheterodyne receivers.
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13. Installing a wireless receiver.
14. Aerial and earth faults.
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16. Reaction faults remedied.
17. How to cure distortion and improve tone.
18. Noises and how to cure them.
19. Hum: its causes and cure.
20. How to read and use wireless circuits.
21. How to construct a wireless receiver.
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